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EDITORIALS

ILLUMINATING ENGINEERING CONVENTION AND LECTURE COURSE.

The annual convention of the Illuminating Engineering Society, which was held in Philadelphia last week, was shorter than most previous conventions have been, in view of the course of lectures which was planned to follow it. The number of papers presented had consequently to be limited and this number was well chosen to fit the time available for technical sessions, as the presentation of papers and the discussions which they aroused almost exactly filled the allotted time. Unfortunately, as has so often been the case heretofore, advance copies of the papers were not available in time for the members to study them and prepare discussion before coming to the convention; and it may be that the discussion was on this account not so full as might otherwise have been the case. The number of papers dealing with commercial subjects seemed to be in smaller proportion than has been usual, but the papers were well balanced and the absence of parallel sessions enabled the members to take full advantage of what was offered.

The attendance at the convention broke all previous records of the Society and the excellent entertainment arranged by the Convention and Local Committees made the days pass pleasantly for both members and lady guests.

Among the papers presented at the convention were two which especially emphasized the progress which is being made by manufacturers in making available for the progressive engineer units which are adapted to attain the best decorative effects without sacrificing good practice from a purely technical standpoint. Among these may be mentioned semi-direct bowls consisting of two parts between which a fabric may be placed and protected from the dirt, and another semi-direct unit which uses a mirrored glass reflector but provides for illumination of the bowl by means of an opal diffuser placed in an opening in the bottom of the reflector, or by the use of a separate lamp for this purpose, which permits the adjustment of bowl brightness to any value which may be desired.

The lecture course was also well attended and a number of members of the Society attended both the convention and the lectures. This was not at all general, however, and a number of those attending the lecture course came for that purpose alone. The course differed from that given in Baltimore in 1910 in that the groundwork of the subject had been covered in the previous set of lectures and it was not considered necessary to go over this material a second time. Indeed, some of the lecturers went so far in assuming knowledge of the previous course and familiarity with the principles and practices of illuminating engineering that it was difficult for many of the hearers to follow them. Explanations upon an elementary basis were very few, but a discussion of prevailing practice and of general ideas can be understood by everyone and a larger part of the lectures were devoted to topics of this nature. The lectures were consequently found more enjoyable as the course was developed and undoubtedly all in attendance profited much from hearing them. The greatest good, however, will only come from a perusal of the printed lectures when they later appear, as most of the lecturers found it impossible to cover their subjects in the allotted time and necessarily omitted many portions which are of value and this broke up the completeness of presentation which might have been desired.

The holding of this lecture course and its support by those interested in the subject is a notable achievement by the Society and one which proves that it is doing a good work in improving the position which this subject holds in the engineering world and in improving the lighting practice of the country. This is by no means, however, the only evidence that the Society is doing a good work. Another such evidence which came out at the convention was the recognition of the Code of Lighting for Factories which the Society has promulgated, which has been adopted by those departments of the state governments of Pennsylvania and New Jersey which have authority in this field. A similar code of lighting for school rooms is in preparation and much further good work of a similar nature may be looked for from this Society in the future.

THE BOSTON ELEVATED RAILWAY INVESTIGATION.

An important investigation of interest to public utilities in general began at Boston, Mass., on September 25, when a special legislative commission sitting at the request of Governor McCall opened an inquiry into the affairs of the Boston Elevated Railway Company, which is in need of additional net revenue. The hearings are likely to extend through several weeks and will go far to determine the future of urban transportation at Boston with respect to continued private ownership and operation. In a carefully prepared brief of about 90 pages, supplemented by a large number of exhibits, the company set forth its financial history, the trend of its fixed and running costs, and showed clearly the limita-

tions of the existing revenue in the face of the burdens laid upon the road by the public in the shape of increased service and investment in rapid-transit lines. In view of the fact that the investment represents the cost of the property to the last dollar, no "water" being a feature of the financial problem, the investigation ought to lead to a constructive program based on what might be called "rock-bottom" values.

Leaving to the street-railway world the detailed figures of this case, the chief interest to engineers and public-utility managers in general lies in the remedies proposed to relieve the company's situation. The company is not as yet at the point of a financial debacle, but the investors are not securing a reasonable return upon their money. In the last three years dividends have not exceeded 5.5 per cent, and in two of these only five per cent was declared. Immediate increases in investment charges and in wages, combined with rising cost of materials, threaten to reduce the above return far below even a tolerable recompense for the capital involved, if, in fact, dividends may not be entirely wiped out. The nub of the whole question is that unless the community assumes some substantial proportion of the cost of financing subways, it will be necessary to increase the rate of fare in order to restore the company to a condition of financial soundness, and to enable it to supply the future transportation facilities needed by the public. In passing, it may be noted that the permanent investment of the company is now $116,022,060, or four and one-half times that of 1897, and during this period the population has increased only 50 per cent and the number of revenue passengers has increased only 110 per cent. The company has never paid dividends in excess of six per cent and to provide a return on the investment in 1916 required 1.616 cents per revenue passenger, compared with 0.986 cent in 1897. Efficient management has done its best.

On a great city system, like that at Boston, an actual flat increase in the rate of fare above five cents is a very serious problem indeed, and the company makes eight other suggestions for the commission's consideration, not urging the adoption of any of the proposed remedies to the exclusion of others, but very properly leaving the solution of the general problem to the investigating tribunal. The fare increase may be necessary, but the following additional, supplementary or alternative remedies are important. The adoption of a zone system of fares; charging for transfers; establishment of prepayment areas where practicable to reduce the number of paper transfers; elimination of eight-cent check tickets used in connection with another road; purchase of the Cambridge subway by the State and its rental to the company; temporarily charging off depreciation against premiums paid on stock and bonds; return of $500,000 deposited with the State, so that it will be available for ordinary capital purposes; reimbursement for subway rentals. The light the hearings are expected to throw upon the comparative merits of the different remedies proposed should be helpful to the company and the public alike, and it is to be hoped that the public will realize before the case is completed that it and it alone must finally bear the total cost of the service which it demands of the utilities that supply it with the necessities of life, and that public operation of such services in the electrical field offers the people as a whole no solution comparable to that possible under efficient private management subject to commission regulation.

A NEW SYSTEM OF CHURCH LIGHTING.

An article upon other pages of this issue describes a system of lighting first installed in St. Adalbert's Church in Chicago and since then applied to other churches of the basilica type, such as St. Mary's of the Lake, Chicago, and St. Mark's Church in Cincinnati. It is also planned to install this system in other churches not yet constructed.

The basilica in Athens was a hall of justice, and in Rome successively a market place, a forum, a court, and a Christian church. From the latter use the word has become associated with ecclesiastical buildings. In plan the basilica comprises a rectangular nave or auditorium with the entrance at one end and the sanctuary at the other. The nave is flanked with colonnades in two stories, and the ceiling is high and flat. Fixtures for artificial lighting are not contemplated in the basic idea of the basilica design and the earliest of these structures provided daylight illumination only. The modern use of churches has necessitated artificial lighting and thus introduced an architectural problem which has not met heretofore with very satisfactory solution. The chandelier, aside from its other objections, is not harmonious with basilica architecture.

The basilica design is naturally adapted to daylight illumination but presents serious difficulties in respect to artificial lighting. In its original application when the building was used as a shrine or a forum there was no need for night illumination and, except for purely ceremonial purposes, no need for artificial lights. Later when used as a place of assembly it became necessary to add seating arrangements to the structure and means for lighting independent of sunlight. The problem of providing those means is complicated by the great height of the ceiling and the architectural requirements. The majesty and simplicity of the basilica calls for a clear open space free from extraneous, hanging devices which tend to reduce the scale and mar the dignity and grandeur of the design.

Many attempts to obtain a satisfactory solution of this problem in particular cases have been made but with rare success if we consider all of the requirements of a good lighting system and architectural harmony. The chandelier system although grievously faulty has become standard because the available lighting units of the past, candles, oil or gas burners, have practically

restricted the choice of fixture to a few large chandeliers or a number of smaller pendants and brackets. The same method has been followed with electric lighting. In this system the first cost is high and the operating effieciency is low. The effect is glaring, uneven in intensity and usually inadequate. The chandelier is so difficult of access that proper cleaning and renewals are seldom given attention. A purely indirect system of lighting is impracticable, even if it were desirable, because of the high ceilings. A system of studded lamps in the ornaments of the columns and ceilings has been tried and while an improvement on the chandelier system, this method is open to the objections of glare, poor distribution, inefficiency, and inaccessibility for cleaning and renewals as well as a high operating cost. More successful have been the attempts to admit artificial light through special windows in the clearstory or the vault of the nave, using prismatic glass in the windows to direct the light downward. Deck lighting has been used with some success in a few cases with flat ceilings. The effect is unnatural and the contrast in the illumination of the upper and lower planes is excessive. None of these methods has solved the general problem involved.

The new system which is described in this article is a combination of direct and indirect cornice lighting which harmonizes with the architecture and is efficient in operation. The cleaning and renewals are accomplished without difficulty and without expert assistance. The average church system of lighting equipment receives far less attention in these respects than it should. Cleaning should be regular and thorough, but it is seldom that this is true. Not only is maintenance much more easily and cheaply accomplished under the new system, but the economy in energy used is greater. The wattage per square foot in the present instance is considerably less than that of several of the largest chandelier systems.

THE PHOTO-ELECTRIC EFFECT.

The term photo-electricity is applied to the phenomenon which is observed when a beam of light is permitted to fall upon certain substances which are negatively charged with electricity. If the conditions are properly chosen, it is found that such substance, regardless of ordinary leakage, will gradually lose its electric charge. For instance, if a plate of polished zinc is placed upon an insulating stand, connected with an electroscope and given a negative charge of electricity, the deflection of the electroscope gradually decreases when the plate is exposed to the light of an arc lamp. If a grounded plate or sheet of gauze of some other metal is placed between the plate and the source of light, the discharge can be observed still better. If the plate be positively electrified, the discharge does not take place, or only very slightly. The experiment may be modified by employing in place of the electroscope a sensitive galvanometer. A battery has its negative terminal connected through the galvanometer to the polished zinc plate, while the positive terminal is connected to the metal gauze. No current will flow until the zinc plate is illuminated, but when a strong light containing ultra-violet rays is thrown upon the plate, the galvanometer will show a deflection.

These experiments show that there is a leakage of negative electricity from certain negatively electrified bodies which are exposed to ultra-violet light. In terms of the modern theory, to which reference has been made in the last two issues, we may say that under these circumstances there is an escape of negative electrons from the body upon which the light is incident.

The substance of which the body is composed has a great influence upon this discharge. The most photo-electric bodies are those which are known to be electro-positive, and the order in which the photo-electric effect is most markedly shown is the same order as that of the ordinary electrochemical series. In other words, the metals which show this effect most strongly are rubidium, potassium, sodium, magnesium, zinc, etc. The least sensitive are the electro-negative metals, such as platinum, gold and silver. Many compounds also show this property, especially certain sulphides and iodides. Prominent among these is the phosphorescent sulphide of barium. Other phosphorescent and fluorescent substances also exhibit this property very strongly, such as fluorspar, silver iodide, and many aniline dyes. There thus appears to be a connection between the phenomena of fluorescence and phosphorescence, and the photo-electric discharge.

The physical nature of the surface and the nature of the atmosphere or gas in contact with it also have a marked effect upon the result. Thus, a polished surface will give a stronger effect than one which is rough or tarnished. Pure, clean, metallic surfaces in a high vacuum not only give strong results, but are free from a deterioration or falling off of the effect with time, which is known as photo-electric fatigue. This is observed in metals which are exposed to the atmosphere for some time.

The condition of greatest importance, however, in determining the amount of photo-electric effect, is the frequency or wave-length of the incident light. The wave-length for which the effect is a maximum is different for different substances. For most of them ultra-violet light has a greater effect than visible light. The effect is independent of the temperature.

Perhaps the most useful practical application of this phenomenon has been in the photometry of faint light sources. The use of such a phenomenon for a measurement of light eliminates from the operation the personal equation, which in one way is an advantage. However, since light intensities are a matter of physiological effect, the substitution of a purely physical effect, therefore, will be satisfactory only when the sensitiveness of the substance used for the photo-electric effect for different wave-lengths is similar to the sensitiveness of the retina of the human eye. This can be accomplished by the use of an absorbing screen properly chosen. For merely comparative purposes, as in photometering variable stars, such a screen can in many cases be omitted.

Happenings in the Industry

Lecture Course of the Illuminating Engineering Society—Arrangements for Local Celebrations of America's Electrical Week—Closing Sessions of Iron and Steel Electrical Engineers' Convention—Philadelphia Electric Co. Denied Use of Telephone Conduit System—Notable Flood-Lighting Installation at Madison—Miscellaneous News Notes

THE LECTURE COURSE ON ILLUMINATING ENGINEERING.

Co-Operative Effort of Illuminating Engineering Society and University of Pennsylvania Well Repaid by Large Attendance.

The course of lectures on illuminating engineering which was given, following the annual convention, under the joint auspices of the Illuminating Engineering Society and the University of Pennsylvania, at the latter institution, was inaugurated by a public meeting on the evening of Wednesday, September 20. Provost Edgar F. Smith, of the university, presided.

Charles P. Steinmetz, president of the Society, made the first address, in which he pointed out the immense scope of illuminating engineering and the number of sciences involved in it. The Baltimore lectures in 1910 served to establish it as a separate branch of engineering. Some consideration of the subject is essential to any complete course in engineering.

Edward P. Hyde, chairman of the Committee on Lectures, was the next speaker. He said that the Baltimore lectures established the scope of illuminating engineering. The present course will supplement the previous lectures and is intended to be very practical.

William A. Durgin then gave a lecture, accompanied by demonstrations, on "Controlled Light," in which he showed in a popular way what can be done to utilize electric light in achieving results which are desirable from artistic, hygienic and utilitarian viewpoints.

The lectures of the course began on Thursday morning, September 21, and continued until Thursday, September 28. About 200 tickets were sold and all lectures were well attended. A week-end trip to Atlantic City was taken on September 23 by a number of those attending. Following the lectures an inspection trip has been planned to include the cities of New York, Boston, Lynn, Schenectady, Buffalo, Cleveland and Chicago.

An exhibition was held in the Engineering Building of the University in connection with the lecture course, the purpose being educational. The exhibits were supplied by the following:

United States Navy Department; Nela Research Laboratory; Eastman Research Laboratory; Philadelphia Electric Company; Bausch & Lomb Company; Wall & Ochs; Nela Engineering Department; Electrical Testing Laboratory; Leeds & Northrup Company; Foote Pierson Company; Corning Glass Works; National X-Ray Reflector Company; Macbeth-Evans Company; Holophane Glass Company; Horn & Brannen Fixture Company; Benjamin Electric Manufacturing Company; Cooper Hewitt Electric Company; General Electric Company; General Gas Light Company; Edison Lamp Works; Westinghouse Electric & Manufacturing Company; Bureau of Standards; Chance & Company; Hirsch Mine Lamp Company; Eveready Company; Frank H. Stewart Company; D. McFarlan Moore; Simon Ventilighter Company; W. D'A. Ryan; Pennsylvania Globe Gas Light Company; Central Electric Company; United Gas Improvement Company.

Abstracts of four of the lectures appear on pages 594 and 595 of this issue. Abstracts of the remaining lectures will be published in subsequent issues.

America's Electrical Week Committees Outline Local Celebrations.

The first meetings of many city committees, appointed in 268 towns and cities to manage local celebrations of "America's Electrical Week," were held during the week past. In most instances reported to J. M. Wakeman, general manager of the Society, the entire personnel of these committees were present. Organization work was completed and the active direction of the big Week's affairs set in motion.

A stimulus to many of these meetings in the South and West was given by the presence of H. W. Alexander and George W. Hill, of the Society's staff. Mr. Alexander is at present touring the middle western cities while Mr. Hill's itinerary takes him through the southern states. Both representatives of the Society report an early interest in the event far exceeding that shown even during the late stages of the campaign last year.

The Coast cities particularly are off to an early start as is evidenced by big meetings held in Seattle and Spokane. Seattle, at the first meeting of the local committee, decided to conduct an electrical show. M. C. Osborn, president of the Northwestern Electric Light and Power Association, reports that Spokane will also have an electrical show, where special emphasis will be placed on moving exhibits.

Reports from Aberdeen, Northern Yakima, Hood River and Walla Walla show strong activities in behalf of the Week. General Manager Davidson, of the Pacific Power & Light Company, has advised the Society that he will want material for branch offices of his company in these cities.

The Portland (Ore.) committee, presided over by Franklin T. Griffith, named financial and arrangement committees at their first meeting and decided to have representatives of all the Portland Civic organizations meet with the committee at Electrical Lunches each day during the Week.

The Denver (Colo.) committee, which will this year handle the celebration throughout the state, has met and contributed details for the state-wide celebration. The festival in Denver last year was one of the most picturesque in America, the occasion taking on all the aspects of a Mardi Gras. Denver plans, this year, to outdo its record last year.

Mr. Hill, of the Society's staff, reports a meeting of the Birmingham (Ala.) committee, comprising 42 leading electrical representatives in that locality of the South.

A meeting of the Charlotte committee was held in the Chamber of Commerce, the entire committee of seven being present. Special committees were named.

The Pittsfield (Mass.) committee has decided to hold an Electrical Fair during "America's Electrical Week." Plans for bringing in more interest than was represented last year were outlined at this meeting. The Fair is to be a co-operative demonstration, an exhibition by all local industries in any wise allied to the electrical industry. The Fair will be handled by the Jovians with T. G. Crawford acting as general chairman.

Two more Colorado cities, Trinidad and Pueblo, have made known their intension of holding celebrations during

the Week. F. P. Wood, of the Trinidad Electric Transmission Railroad & Gas Company, has charge of the arrangements for the celebration in Trinidad, while W. F. Raber and E. F. Stone, of the Arkansas Valley Railway, Light & Power Company, have been appointed on a committee to arrange for the Pueblo celebration.

Louisville Jovians took a big step toward their America's Electrical Week demonstration with a smoker-meeting on September 19. George W. Hill was the principal speaker. A feature of the meeting was the testimony of last year's exhibitors that the exhibitions proved extremely profitable as sales producers. More attention will be paid this year to commercializing the show than was the case last year. Several electric-sign companies and 10 of the leading Louisville contractors will begin a co-operative campaign to induce the merchants to install decorative lighting. The Louisville Gas & Electric Company will put extra effort behind its house-wiring campaign.

The Cincinnati show this year will be known as the Ohio Valley Electrical Exposition and will be widely advertised as such for more than 100 miles in all directions from Cincinnati. In addition to last year's exhibitors a great many additional manufacturers and retail dealers have signified their desire of participating. Though the purpose of the show is to familiarize the public with electrical devices, such a show cannot depend upon its self alone to draw people. Last year transcontinental telephone demonstrations attracted many people, and this year the show will have fully as great a drawing power. The immense stage of Music Hall will be covered by a coating of ice, frozen by electrical refrigerating machinery and lighted from beneath by electrical lights of many colors. A troupe of professional ice skaters has been secured to give demonstrations. The illumination of the interior and exterior of Music Hall will be even more brilliant than last year, and valuable prizes will be offered for window, store and building illumination by firms and individuals.

Owing to the immense amount of detail work in connection with plans and publicity for the Week additions have been made to the staff of the Society for Electrical Development. E. M. Hunt, formerly advertising manager of the United Profit Sharing Corporation, has joined the Society's staff under H. W. Alexander, director of publicity. F. C. Myers is now with the Society's Publicity Staff as trade-press editor and also in direct charge of its "Highway Lighting Campaign."

CLOSING SESSIONS OF IRON AND STEEL ELECTRICAL ENGINEERS' CONVENTION.

Joint Session with A. I. E. E. and Paper on Motor Control for Cranes Features of Successful Meeting.

As indicated in last week's report of the opening sessions of the tenth annual convention of the Association of Iron and Steel Electrical Engineers, held in Chicago, Ill., September 18-22, the meeting was the most successful convention ever held by that body. The convention was replete with excellent papers on subjects vital to the profession and interesting discussion by a large number of those in attendance, with opportunities afforded for inspection of plants near Chicago, and with an interesting program of entertainment for the delegates and their wives.

Joint sessions were held with the American Institute of Electrical Engineers, Wednesday, September 20, at which T. E. Tynes, of Lackawanna, Pa., as chairman of Iron and Steel Industry Committee of the A. I. E. E., presided. The first paper was one prepared by George J. Newton, designing engineer with G. M. Gist, New York City, on "Underground Distribution Systems," and read by H. B. Gear, of Chicago. This paper showed the importance of properly designing an underground distribution system for the district to be served and the particular service it is to supply. Many suggestions were given for designing and for reducing installation costs and securing efficient service. The paper was discussed by Messrs. Hovey, Egan, Shover, Coey, Hammel, Woodhull and Gear.

The next paper was on "The Unaflow Engine," by Prof. W. Trinks, of the Carnegie Institute of Technology, which showed the economy of this type of prime mover in steel mills where sizes less than 8,000 kilowatts are required. The discussion was participated in by Messrs. Coey, Emmons, Breslove, Wilson, Tynes, Egan, Stoltz and James, and indicated a preference for electric drive over steam-engine drive for steel mills.

The Wednesday afternoon session was opened with a paper on "Steel Conductors for Transmission Lines," by H. B. Dwight, of the Canadian Westinghouse Company, which gave test data, indicating that steel cables can be used profitably on branch lines of power systems of all voltages, but are not economical on main transmission lines, except for long spans and for high altitudes where corona is excessive. Steel cables for alternating current

Tenth Annual Banquet of the Association of Iron and Steel Electrical Engineers.

Noted for the atmosphere of dignity and seriousness, combined with sincere good fellowship, the meetings of the Iron and Steel Electrical Engineers have been exceptionally successful. At the 1916 banquet, Captain Hunt, of the R. W. Hunt Engineering Company, was toastmaster, and speeches were made by W. T. Snyder, the retiring president; F. D. Egan, the president-elect; Peter Junkersfeld, of the Commonwealth Edison Company, and others. A. H. Schwartz, chairman of the convention committee, was presented with a watch as an appreciation for his efforts toward making the meeting a success.

should be finely stranded and different groups of wires spiraled in opposite directions. The characteristic increase of resistance and reactance with current or frequency increases may be valuable for limiting surges and short-circuit currents. He advocated tests of medium-priced steel cable manufactured in America so that the data can be used in designing transmission lines. The paper was discussed by Messrs. Doane, Worcester, Rushmore, Coey and Snyder.

The session was closed with a paper on "The Advantages of Modern Types of Direct-Current Machines," by David Hall, of the Westinghouse Electric & Manufacturing Company, which gave the advantages of commutating poles and compensated windings for direct-current machines. Messrs. Caldwell, Downs, Stoltz, Coey, MacCutcheon, Petty and others participated in the discussion, which indicated an opposition by steel-mill operators to complicating changes in motor design.

The first session on Thursday was opened with a paper on "The Mechanical and Electrical Operation of the Heroult Electric Arc Furnace," by G. W. Richardson, of the American Bridge Company, Pencoyd, Pa., which was a description of the apparatus and electrical equipment of a furnace operated at the Pencoyd Works. R. Tschentscher spoke of his experience with a 15-ton furnace which had been in operation seven years, and stated the greatest disadvantage is the voltage drop between the transformer and electrodes, and that the complication of the control of the latter should be avoided. Walter Greenwood said the electric furnace furnished the heat control necessary for refining steel, the other two necessities in refining being correct chemical composition and proper time of treating which can easily be taken care of. Others discussing the paper were Messrs. Hinkley, Menk, Rushmore and Henderson.

E. S. Jefferies read a paper on "The Operating Characteristics of an Electric Reversing Blooming Mill," the mill in question being that of the Steel Company of Canada, Hamilton, Ont. The mill is driven by the Ilgner system, which employs a heavy flywheel in conjunction with a motor-generator set and a device for enabling the use of the stored energy of the flywheel when the demand for power is great. A description, costs and advantages were given. The paper was discussed by Messrs. Egan, Pauly, Petty, Stoltz and Crosby.

The Thursday afternoon session was opened with a paper on "Voltage Standardization," by M. D. Cooper, of the National Lamp Works, which recommended the adoption of standard voltages of 110, 115 and 120 instead of the various potentials now in usage.

This paper was followed by a paper on "The Control of Direct-Current and Alternating-Current Motors as Applied to Cranes," presented by Paul Caldwell, of the General Electric Company. The paper was noteworthy because of its completeness and the handling of the subjects of dynamic braking and magnetic control. The discussion was opened by A. H. Cederlund, who spoke on variable-speed motors for cranes, followed by F. J. Burd, who gave the results of a series of tests on dynamic braking. J. C. Reed gave the details of a switching circuit for obtaining low hoist speeds. The paper and subject were discussed by a large number of the delegates, including Messrs. Petty, Galbreath, James, Gilpin, McLain, Fishback and Henderson.

The last paper of the convention was presented by A. M. Andresen, of the Van Dorn Electric Tool Company, on "Portable Electric Tools as Applied to the Iron and Steel Industry." The paper considered electrically-operated drills, reamers and grinders and an outline of their development and application was given. In the discussion, F. A. Wiley spoke on slow-speed electric drills for tapping furnaces, and C. B. Coates on compound windings for tool motors and speeds for different classes of work. Messrs. Richardson, Egan and Woodhull also participated in the discussion.

A large delegation of those in attendance at the convention visited the power stations of the Commonwealth Edison Company Tuesday, the plant of the Illinois Steel Company, at Gary, Ind., Thursday morning and the new Chicago municipal pier Thursday afternoon.

The entertainment features were prominent and included a reception and dance Monday evening, vaudeville entertainment Tuesday evening, and annual banquet and ball Wednesday evening. Trips to various points of interest in Chicago were arranged for the ladies.

Philadelphia Electric Company Denied Use of Conduit System.

The application of the Philadelphia Electric Company and the Keystone Telephone Company for approval of a proposed lease of the telephone conduit system in Philadelphia by the electric company has been denied by the Pennsylvania State Public Service Commission. The contract provided for the leasing of the unused telephone conduits for a period of 21 years, dating from January 1, 1915, at an annual rental of four cents per foot of duct space actually occupied, with minimum payment of $25,000 the first year, and to be increased each year by $12,500 until, and including 1921, and thereafter, for the last 14 years of the lease, with a minimum of $100,000 per year; the contract carried a renewal privilege of 15 years, during such period the minimum annual rental to be $125,000.

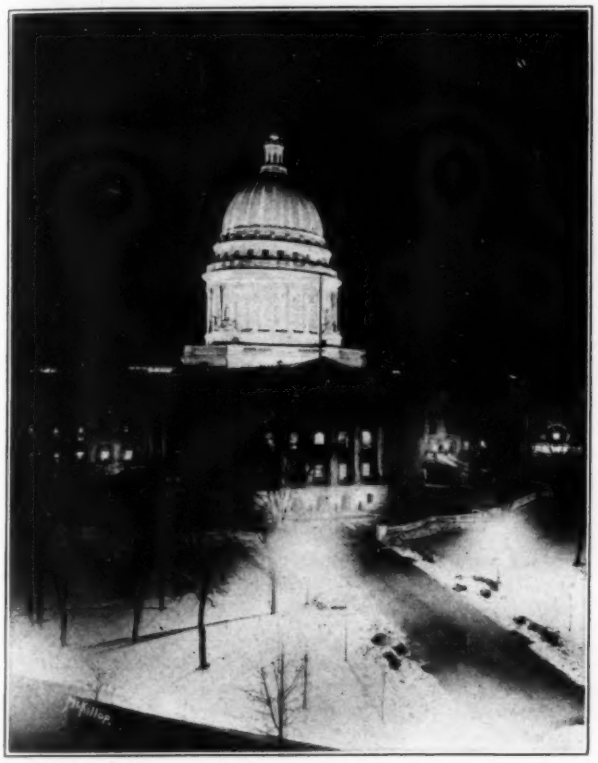
The city filed a protest with the Commission against the approval of the contract, holding that such agreement should specify within what period of years the overhead wires of the electric company would be installed underground, and, further, protesting against the amount of the per foot annual rental.

In upholding these contentions, the Commission says that the heavy rental would work a hardship on the patrons of the electric company, and that the lease should provide for the gradual burying of aerial wires over a fixed period of years,—five, seven or ten. The Commission also sets forth that a fatal error in the proposed contract is the absence of a maximum annual rental, stating as follows:

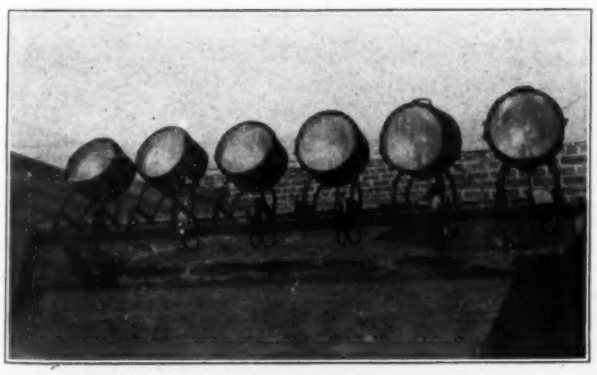
"The underground conduit system of the telephone company comprises 12,000,000 feet of ducts, of which it has in actual use 2,000,000 feet; the remainder (10,000,000 feet) is the subject of the contract. The petitioners estimate the system to be worth $4,079,000, while the city stipulates the value as $3,000,000; both sides agree that seven per cent would be a fair return. No one can say how many of the 10,000,000 feet of conduit may be occupied by the electric company, but it is not entirely inconceivable that the entire may be used, in which case the company will be required to pay $400,000 a year from its gross revenues, or more than 13 per cent on an assumed valuation midway between the amounts specified by the company and city, respectively. A material oversight in the contract is the failure to provide for an allowance or reduction of the minimum annual rental if and to the extent the telephone company itself will use the ducts. The contract is too highly speculative to meet the approval of the Commission; under the contract a large part of the gross revenues of the electric company paid to it by the consumers of electric energy would be paid to the stockholders of the telephone company. Our concern is solely in the interest of the public, the patrons of the electric company; there may never be a single foot of the conduit used, but there must be paid annually $100,000; there may be a great amount used, possibly enough to absorb $400,000 a year, perhaps twice as much as a fair return upon the investment. In either event, the patrons of the electric company would be mulcted for a long period of years."

Illumination of Wisconsin's Capitol Dome a Splendid Example of Flood Lighting.

One of the finest examples of flood lighting has recently been completed at Madison, Wis. It is the flood illumination of the dome of the new State Capitol of Wisconsin which has been ten years in the building. About $7,000,000 has been wisely expended to create a gem of architectural beauty. From the four main approaches to the lantern of the dome there is no break in the purity of the gleaming white Vermont granite, except as it is relieved by the green of lawn and foliage. The state has also been generous in beautifying the interior of the building, which is adorned with rare and beautiful marbles, granites, mosaics and mural paintings. Surmounting the dome, 286 feet from the ground, is a heroic statue in gold, symbolic of the motto on Wisconsin's seal "Forward."



Capitol Dome at Madison Flood Lighted.



Battery of Projectors On One Wing of Roof.

The Wisconsin State Capitol is built in the form of a Maltese cross, set diagonally in Capitol Park. A circular dome, springing 220 feet from their roofs, unites the four wings of the cross. The extremes of the wings are 206 feet from the center line of the dome. Conditions, therefore, for flood lighting the white dome with its gilded statue are as nearly ideal as could be desired.

The installation was made according to specifications prepared by engineers of the Illuminating Department, General Electric Company. Forty-eight J 8, G E headlight reflectors housing 500-watt, 110-volt Mazda stereopticon lamps mounted horizontally, form four batteries of 12 flood-lighting units each. A skylight on the roof of each wing divides each battery into two groups of six projectors as shown in the general plan, but each battery is also divided into four illuminating groups of three projectors each. The first group of three is elevated 10 degrees, the second group 20 degrees, the third group 30 degrees and the fourth group 40 degrees. The directions of the beams, however, are not arbitrary, for the beams are so distributed as to eliminate spotting and unevenness of illumination. Control for the entire four batteries of projectors is had by means of a knife switch located on the lighting panel of the main switchboard in the basement of the building. Angle-iron frames support the projector fixtures and weatherproofing wire and conduit fittings (where exposed on the roof) insure uninterrupted service.

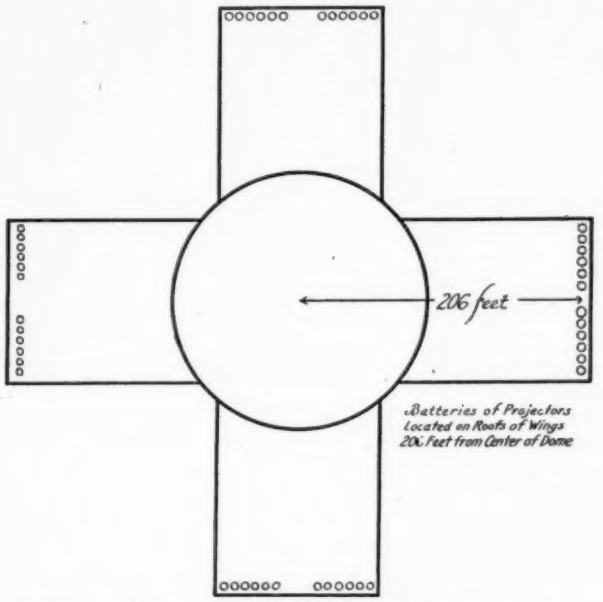


Diagram Showing Location of Projectors with Reference to Dome.

The following is a summary of the illuminating data of this installation:

Volts	110
Amperes	218
Watts	24,000
Illuminated area, square feet	47,700
Watts per square foot	0.074
Average illumination, foot-candles	3.77
Illumination at level of roof wings, foot-candles	4.5
Illumination of dome lantern and statue, foot-candles	13.0

Telephone Pioneers Change Meeting Date.

Owing to unavoidable circumstances, the Committee of Arrangements of the Telephone Pioneers of America has been compelled to change the date of the sixth annual meeting from October 19 and 20 to October 27 and 28, as well as the official headquarters from the Georgian Terrace Hotel to the Piedmont Hotel, Atlanta, Ga. In view of these changes the Transportation Committee, which is in charge of A. L. Salt, announced that the special train for the convention will leave New York on Wednesday, October 25 at 5:40 p. m. from the Pennsylvania Station. The itinerary will otherwise be the same as published in our issue of September 9.

Miscellaneous NEWS NOTES

San Francisco Illumination Carnival Postponed.—The illumination carnival to be held in San Francisco, Cal., in celebration of the installation of the new "Path of Gold" lighting system on Market Street has been postponed from September 20 and 21 to October 5 and 6 in order to give time for more elaborate preparations.

Hawk Short-Circuits 33,000-Volt Line.—An investigation as to the cause of short-circuiting of a 33,000-volt line of the Kentucky Utilities Company, near Middleboro, Ky., which tied up the electric service for several hours, disclosed a dead hawk on wires on a crossarm. The bird had alighted on the wires on a crossarm in such a manner as to make the connection. It was instantly killed, but had fallen in such a manner that the connection was not broken.

Dayton Jovians Meet.—One of the largest rejuvenations ever held by Jovians of Dayton, O., is being planned for October 2, partly as a means of boosting the national convention to be held at Indianapolis, October 18-20. C. W. Hosier, Dayton manager of the General Electric Company, was appointed chairman of the Dayton "On to Indianapolis" committee, and has charge of the details. The first monthly meeting of the organization since spring was held on September 11, with City Manager Waite as the chief speaker.

Electric Companies Not to Merge.—It has been reported that the Mt. Whitney Power & Electric Company will not merge with the Pacific Electric Company, as reported some time ago. At a meeting of the directors of the Mt. Whitney company G. C. Ward, of Los Angeles, was elected president; A. M. Kemp, of Los Angeles, treasurer; Ben M. Maddox, Susman Mitchell, W. R. Spalding, C. R. Blyth and E. R. Davis, directors. Fred G. Hamilton is to be superintendent of the western division, and Arch Robinson of the eastern division. R. E. Smith will be in charge of the sales department. President Ward stated that the company would not be merged with the Pacific company.

Daily Paper Enlivens Convention.—One of the features of the recent convention of the Pennsylvania Electric Association, held at Eagles Mere, Pa., was the issuance of a Daily giving the news of the preceding day and the program and entertainment features scheduled for each day of the convention. There were also a considerable number of personal notes and human-interest items which made the publication eagerly sought for each morning. A portion of each issue was printed at the plant of the Westinghouse Electric & Manufacturing Company in advance of the convention and the current matter was printed on the presses of the Hotel each evening. J. C. McQuiston, publicity manager of the Westinghouse Company was managing editor of the Daily and received many congratulations on the able manner in which he handled the work. He was assisted by H. B. Kirkland as sporting editor and M. C. Turpin as news editor. The Dailies were issued by the exhibitors.

Interstate Public Service Company Signs New Contract With Seymour, Ind.—After a controversy extending over a period of two years a contract has been signed by the Interstate Public Service Company and the city of Seymour, Ind. The Public Service Commission started an appraisal of the company's property in Seymour in August as a preliminary step in settling the controversy, but stopped on the condition that an agreement as to rates would be reached. The new schedule provides a sliding scale of rates, beginning at nine cents for the first 15 kilowatt-hours and decreasing to five cents for more than 600 kilowatt-hours a month. A discount of 10 per cent is provided for prompt payment of bills. Power rates start at five cents a kilowatt-hour and are as low as 2.5 cents for large consumers. The minimum meter charge is reduced from 75 cents to 50 cents. A post lighting system for the business district is to be supplied at five cents a kilowatt-hour. Arc lamps will be removed when the post lamps are installed.

Hearing on Electric Rates.—The Board of Public Utility Commissioners of New Jersey called a meeting at Trenton, N. J., on September 25 to consider the petition of Jersey City and neighboring municipalities for lower rates for electric lighting in territory served by the Public Service Electric Company. The Board has been investigating the rates now charged by the company with the idea of instituting a uniform rate.

Electric Sign to Guard River.—Following the death of a member of the Coast Guard Service at Louisville, Ky., Capt. Jack Gillooly, in command at Louisville, has recommended to the War Department that a large electric sign be placed over the Ohio falls at Louisville to warn those unfamiliar with the river of the dangers of the rapids. The deceased lost his life in the work of saving a party from death in the falls some time ago.

"Light Night" at Kentucky Fair.—"Light Night" was a feature of the Kentucky State Fair, at Louisville, this year, the date being Wednesday, September 13. The purpose of the directors of the fair was to provide for and authorize every conceivable manner of illumination. It was planned to have the grounds ablaze with every variety of colorful, bizarre and mirth-provoking kind of illumination possible, and notice was served that every visitor would be expected to carry some sort of lantern, searchlight, torch, or flashlight, provided it was of a design such as to make it devoid of danger from fire. A prize was offered for the person bearing the most unusual light or decoration. The Pike was brilliantly illuminated and there was much gaiety and much light. In addition to the lighting demonstration at the fair, the city itself was especially illuminated for the occasion.

Pennsylvania Lighting Companies Merge.—Papers have been filed in Pennsylvania for the incorporation of the Midland Electric Light & Power Company, a concern with $65,000 capital, which has just been formed by the consolidation of 11 small electric light companies in and around Beaver County. The new concern is a subsidiary of the Beaver County Light Company and of the Duquesne Light Company. It was announced that the various companies thus consolidated have been controlled by the Duquesne Light Company for some time. The companies affected are the Ohio Township, Potter Township, Raccoon Township, Ferry, Georgetown, Midland, Glasgow, Hanover, Hookstown, Independence and Industry Light companies. The officers of the Midland company are: President, S. L. Tone; vice-president, James D. Callery; secretary, W. B. Carson; treasurer, C. J. Braum, Jr., and controller, C. S. Mitchell, all of Pittsburgh.

May Construct Plant to Supply Texas Farms with Electricity.—C. M. Cureton, assistant attorney general of Texas, is leading a movement to bring about the enactment by the Legislature at its coming session of a law that will authorize the formation of public utility districts and the issuing of bonds, the proceeds to be used for constructing electric generating plants and the building of transmission lines for providing power for operating machinery upon the farms that are embraced in the respective districts. It is stated by Mr. Cureton that by forming power districts under the plan proposed farmers would be able to obtain their power for pumping wells, operating irrigation pumping plants and a variety of other purposes at nominal cost. He cites the fact that during the last few months hundreds of gasoline engines have been installed upon farms in Texas and that the individual cost of furnishing this power is much heavier than it would be if it were generated in a central station and distributed by means of transmission lines.

Lighting a Church of the Basilica Type

Details of a New Lighting System Which Has Been Used in Two Prominent Chicago Churches and Which Embodies a Combination of Direct and Indirect Lighting

A NEW system which has been designed for lighting basilica churches is well exemplified by the installation in St. Adalbert's Church, at Seventeenth and Paulina Streets, Chicago. The interior of this church is shown in Fig. 1, lighted by the new system. Other churches are now being lighted by the same method, another notable installation being St. Mary's of The Lake, at Sheridan Road and Buena Street, in the same city. In St. Adalbert's Church the nave is 156 feet in length, 65 feet wide and 70 feet high. The corresponding dimensions of St. Mary's Church are 120 feet, 52 feet and 56 feet. Henry J. Schlacks, the architect of these buildings, is responsible for the original conception of the scheme and is using it in other churches now being designed. The details were worked out by Miller and Pardee, illuminating engineers, and the installation of the electrical equipment was carried out by the Tank Electric Company, of Chicago.

The lighting system here used is a combination of direct and indirect lighting. As a system of illumination it has the advantages of freedom from glare, low intrinsic brilliancy, good diffusion, absence of intense shadows, and a uniform intensity of illumination. It also shows advantages from the standpoints of depreciation and operating economy, since the units are easily accessible and easily cleaned, and renewals of burnt-out lamps can be made without difficulty. The power consumption is also said to be less than that applying to other churches with equally intense illumination.

The principal part of the lighting for the auditorium issues from the under side of an interior cornice. This cornice, which is about half way up on the side walls is of reinforced plaster and is hollow, with a slot running the whole length on the under side. Directly over the slot is a metal light box and closing in the slot are sections of Alba glass, semi-circular in section, and curved in a special cylindrical mold to fit the profile of the cornice. This glass is smooth on the inside and rough on the exterior with reed and ribbon decoration. It forms a decorative part of the cornice. The light box, shown in Fig. 2, contains a wiring trough and supports the lamp sockets. The lamps are 60-watt tungsten lamps, placed 16 inches apart and about eight inches above the glass with their axes at right angles to the line of the cornice. The lamps have individual, parabolic, mirrored glass reflectors and the whole equipment is protected from dust by the metal light box. In St. Adalbert's Church there are 105 of these lamps on each side.

The indirect lighting has the purely decorative function of displaying the relief work in the ceiling which would otherwise be invisible at night and offer too much contrast in illumination of the upper and lower parts of the nave. The indirect lamps are 100-watt lamps in parabolic,

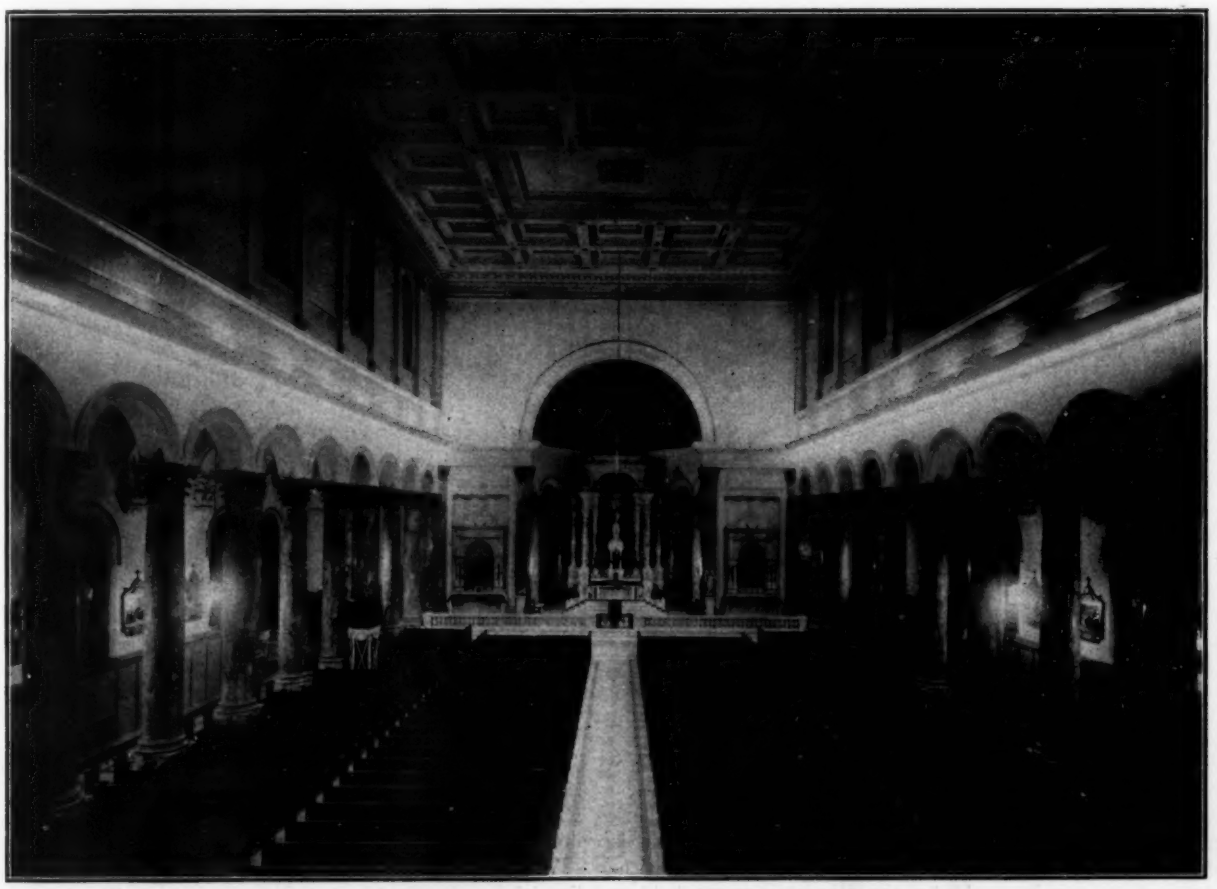


Fig. 1. Interior of St. Adalbert's Church, Chicago, Showing Employment of a New System of Illumination.

mirrored reflectors placed 21 feet apart on top of the cornice. It is important that these reflectors be placed below the line of vision and in such a position that none of

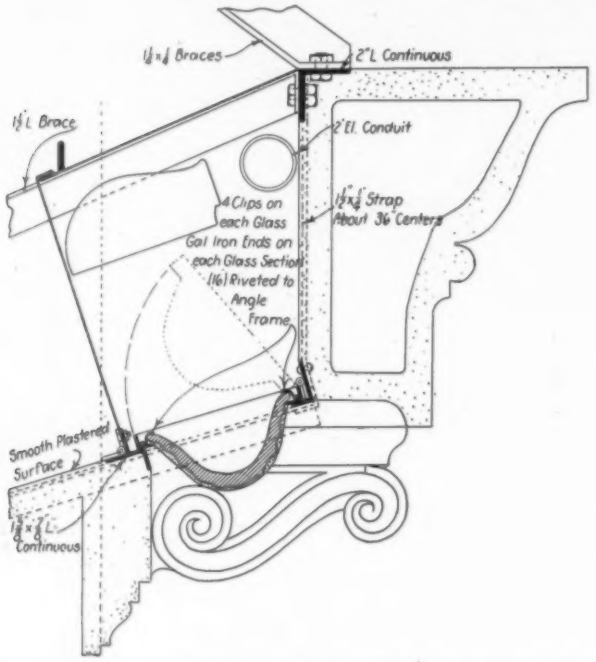

1½×¼ Braces
2"L Continuous
1½L Brace
2"El. Conduit
4 Clips on each Glass
Gal Iron Ends on each Glass Section (16) Riveted to Angle Frame
⅛×1½ Strap About 36" Centers
Smooth Plastered Surface
1½×1½ L Continuous

Fig. 2. Section of Cornice Showing Hinged Panels and Light Box.

the light is reflected back upon the adjacent wall. It is possible in this manner to illuminate the ceiling perfectly without showing the slightest indication of the light source.

The accessibility of the equipment for renewals and cleaning is one of the most important features contributing to its success and the maintenance of a high efficiency. The rear of the cornice is made of hinged panels opening directly into the long chamber under the side roof. This makes it extremely easy for the attendant to reach all of the lamps and reflectors and the diffusing glass from behind the cornice. The Alba glass is mounted in hinged sectional frames arranged to fold over on a table and

Fig. 3. Accessibility of Lighting Equipment.

allow of cleaning the under side conveniently. This is shown in Fig. 2. This feature is most essential, for without such means it would be necessary to mount ladders some 35 feet in length from below, a proceeding so dangerous and troublesome for the average caretaker as to practically preclude the operation.

Fig. 3 shows a section of the Alba glass turned up on its hinge while the observer is making an inspection of the light box. This view is taken in St. Mary's Church, but the arrangement is the same as in St. Adalbert's Church, except that in St. Mary's the sections of Alba glass are separated by brackets on the under side of the cornice. On the upper side may be seen the lamps and reflectors used for the indirect illumination, but these are invisible from the floor of the church. Fig. 2 shows very distinctly the position of the conduit bearing the wiring to the lamps, the position of the reflector over the lamp and the position of the Alba glass, both normally and when lifted upon its hinged support. The back of the light box is also hinged, thus giving access to the trough, which is ordinarily completely inclosed and thus protected from dust. Fig. 2 applies to St. Mary's Church, but the arrangement is the same in St. Adalbert's Church.

In St. Adalbert's Church the lighting is entirely controlled from a cabinet in one end of the church near the sanctuary. Interior and exterior views of this cabinet are shown in Fig. 4. The cabinet contains plug fuses for each of the circuits and also a group of control switches. *M* is the main switch controlling the incoming current. This current leaves the busbars by three switches. Switch *N*

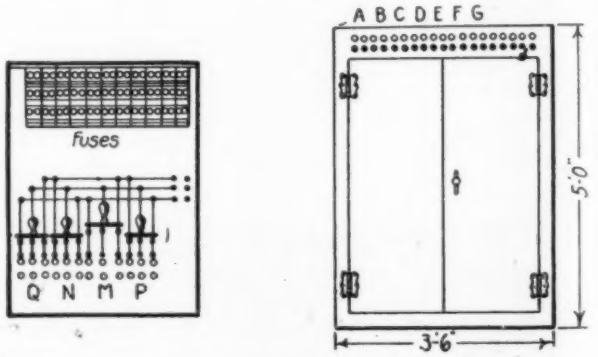


Fig. 4. Interior and Exterior of Control Cabinet.

controls the cornice lighting, switch *P* the vestibule lighting and switch *Q* the sanctuary lighting. The wires leaving these three switches pass to the push-button switches which are shown at the top of the cabinet on the outside. These push-button switches give control of the cornice lighting in sections, as well as of the other church lighting. These switches are arranged in pairs, so that a single motion of the hand will light corresponding sections of the cornice lamps upon opposite sides of the church. Fig. 5 shows how the lamps in the various bays are grouped for this control. There are seven switches for each side of the church, designated by the letters *A* to *G*. There are 13 bays on each side of the church and each bay contains eight lamps. Since the bays near the altar are required to be lighted more often than the others, the system is arranged so as to control these separately. As will be seen in Fig. 5, switch *A* controls parts of bays 1 and 5; switch *B* parts of bays 9, 11 and 13; switch *C* parts of bays 3 and 7; switch *D* parts of bays 2, 4 and 6; switch *E* parts of bays 8, 10 and 12. One lamp in each bay is controlled by switch *F* and another by switch *G*.

Arrangements have been made to control the entire lighting by dimmers in case it is decided to install this apparatus, but up to the present time this has not been done.

With all lamps lighted the intensity of illumination in St. Adalbert's Church is about one foot-candle and is uniform within six per cent over the entire floor.

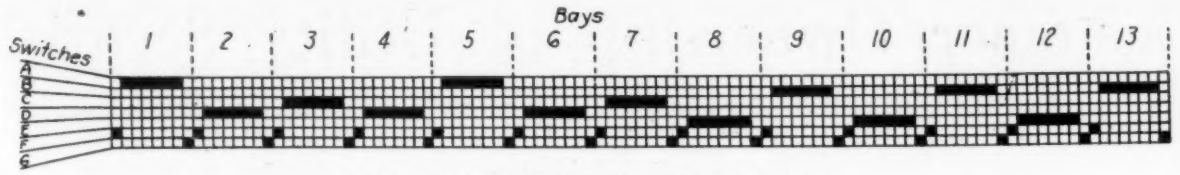


Fig. 5. Diagram Showing the Grouping of Lamps.

Additional local lighting is used in those parts of the church where it seems to be necessary. The sanctuary, the organ loft and the vestibule, of course, all have localized lighting. In the corridors which run along each side of the church between the columns and the outside wall, lanterns are hung. A view of the lanterns used in St. Mary's Church is given in Fig. 6. These lanterns have frosted glass on the side facing the interior of the church and clear glass on the side facing the wall. In this way sufficient light is provided for the confessional closets along the side walls of the church.

Slight variations of the plan used in St. Adalbert's Church are being used elsewhere. These include brackets on the under side of the cornice which break up the continuous line of light, as in St. Mary's. In any installation the proportion of direct and indirect lighting can be varied to suit the conditions and the color scheme.

Activities of Massachusetts Contractors' Association.

Next January the Electrical Contractors' Association of Massachusetts is to publish a revised list of master electricians in the state, on the order of a publication printed several months ago, which was the initial number. Jobbers and manufacturers were liberal in their advertising patronage, and it is hoped by the officers of the association that this kindness will be renewed.

Several weeks ago the special representative, J. E. Wilson, sent about 200 letters to members and others asking:

(1) How is the licensing law working in your district?

(2) Are there any people working without a license?

(3) Do you derive any advantage from the law?

(4) Are you troubled with journeymen taking contracts in your district?

(5) Do you know absolutely of anyone obtaining a license by fraud?

Fig. 6. Lanterns in St. Mary's Church.

(6) Are you willing to appear in court against them?

(7) Have you any suggestions as to a change or amendment in the law?

(8) Have you talked with your (state) representative or senator in regard to the law?

(9) Will you, when the time comes, consult with your member and urge him in the interest of the public to give any amendment favorable consideration?

The office has received many replies, which will be used as a basis for framing new amendments to the law. It is hoped to improve the present licensing act by legislation at the 1917 session of the General Court.

A case of alleged wiring of buildings in Lynn, Mass., without a license, was recently before the municipal court. The case was filed on payment of $15 as court costs. Testimony showed that the defendant had applied for a license but had not followed it up and secured it. In spite of his having no license he continued to work until summoned. When the case was first taken up, it is said the mayor and police department admitted they had no knowledge of the law.

It is urged that when the new law was passed it was the duty of the mayor, police department, or wire department to inform the public as to its provisions in order to obviate violations and protect the public from workmen who are not certified as competent by the state.

On September 26 to 28 a convention of New England electrical contractors was held at Hartford, Conn., at which licensing was one of the important topics discussed.

Colorado Electrical Convention Successful.

J. A. Clay, of Montrose, was elected president of the Colorado Electric Light, Power and Railway Association at the convention of the organization held at Glenwood Springs, Colo., September 21 to 23. Other officers elected were: L. G. Hammond, of Denver, vice-president; Thomas Kennedy, of Denver, secretary and treasurer; F. P. Wood, Trinidad; W. F. Raber, Pueblo; J. J. Cooper and W. C. Stearne, of Denver, members Executive Committee.

This was the fourteenth annual convention of the association and the thirteenth to be held in Glenwood Springs. All of the sessions were held at the Hotel Colorado, which had been highly decorated with electrical effects by the Glenwood Springs Light & Water company.

The business sessions were largely devoted to programs of addresses and papers devoted to live electrical subjects and public utility questions. A paper read by L. H. Titus, manager of the Sterling (Colo.) electric plant, was devoted to "Electric Ranges." The subject of "Electric Lamps" was ably handled by S. E. Doane, chief engineer, National Lamp Works, Cleveland, O. "Rates for Lighting, Cooking and Power" was the subject of a paper by L. G. Hammond, general manager, Colorado Power Company.

M. H. Aylesworth, chairman of the Colorado Public Utilities Commission, and F. W. Herbert, statistician of the same commission, presented a number of interesting comments from the viewpoint of the commission.

America's Electrical Week, which is to be held December 2 to 9, was discussed by H. W. Alexander, representing the Society for Electrical Development. F. P. Wood aroused much interest by his subject, "Tell the Public What You Are Doing."

Customer Ownership of Utility Securities

Results of the Plan Adopted by a Large Syndicate for Making Customers of a Utility Company Its Financial Partners Through the Purchase of Small Allotments of Stock—From a Paper Presented Before the Colorado Association

By William H. Hodge
Manager, Publicity Department, H. M. Byllesby & Company

INDUCING the consumers of public utility service to become financial partners in the enterprise is a movement which has made considerable progress during the past year.

The subject of offering and selling the securities of utility companies to citizens of the communities served was discussed by H. M. Byllesby & Company for a number of years before it was actually begun in June, 1915.

Opinions of investment bankers and many public utility operators were discouraging. Predictions were made that any scheme of broad distribution of utility securities in home territory—outside of the financial centers—would be a failure. However, the success of the Pacific Gas & Electric Company in finding a market for a large amount of six-per-cent preferred stock in California indicated that in some parts of the country, at least, the public could be persuaded to invest in the securities of electric and gas companies which were part and parcel of their own communities. Other instances existed also where service organizations enjoyed a considerable home or customer ownership, and it was determined to proceed with the plan in an experimental way at the cities and towns served by the Northern States Power Company.

During the last 15 months upwards of 1,475 people in the territory served have purchased or started to purchase approximately $801,000 par value of the preferred stock. Of this number approximately 1,100 have bought this stock outright, paying cash for it, and about 375 are buying on partial payments. In addition to this from 100 to 200 individuals have made investments in the common stock of the company and in its bonds and coupon notes.

These results are by no means startling but they may be regarded as a fair beginning in an undertaking which will grow steadily and which has far-reaching possibilities of the utmost importance to the company and its fortunes. In June, 1916, stock was sold to 220 people or four times the number purchasing in June, 1915.

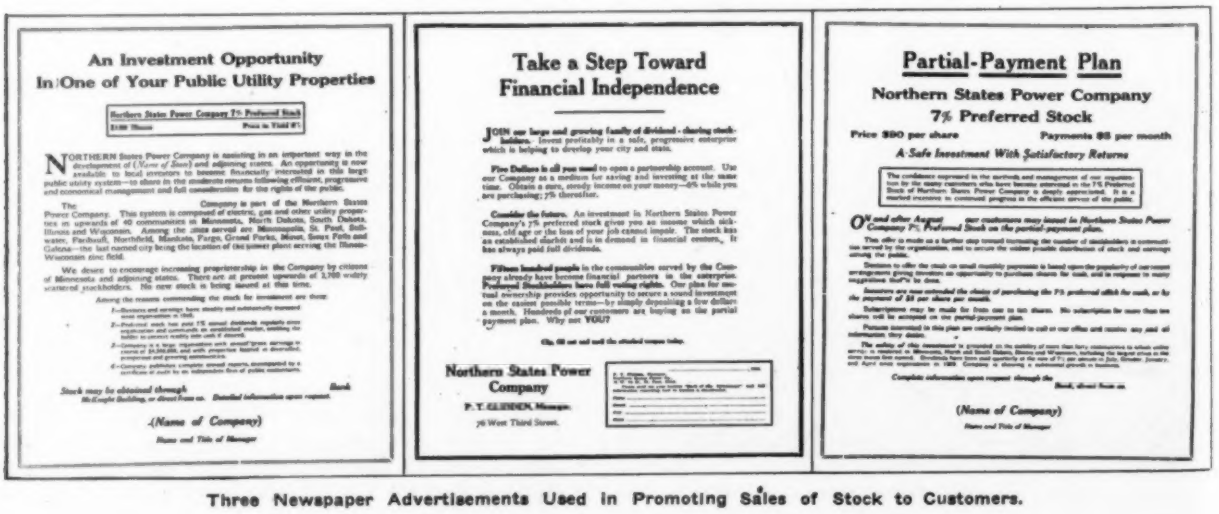
It has been demonstrated to our satisfaction that a broad distribution of the securities of a utility company may be secured among the company's own customers by serious, careful and persistent effort over a reasonable time, or say a period of from three to five years. It is not sensible to expect a new movement involving the funds and savings of the people to accomplish faster headway.

Benefits to Public and Companies.

The benefits to the utility company and the public which assuredly will follow a wide distribution of a company's securities among its patrons warrant the effort and initial expense. The objects falling within range include the most vital things in the relations between the utilities and the people. Achievement will go a long way towards solving controversial difficulties which have marred these relations in the past.

Customer ownership is nothing more or less than a mutualization of the utilities. It means popular, but not municipal, ownership. It will give the consumer of utility service a measure of proprietorship in the service organization and render to him a share of the profits indispensable to any commercial organism which is to perform its functions to society progressively and efficiently. It will make the people financial partners in the service companies and at the same time preserve the responsibility, initiative and economy of private enterprise. It opens the door in a friendly way to every citizen who is able to produce and save a few dollars and makes him a co-operating friend instead of a suspicious, envious antagonist.

Customer ownership will not mean a license for excessive profits or indifferent service. It will not permit a corporation to obtain undue favors from the legislative bodies of states and cities. It will not give a company political security unless it keeps itself modern and efficient. But customer ownership will establish friendly connections with a large number of citizens and voters, will share with them the earnings from the business and will so modify destructive criticism as to approach within reasonable distance of the equation which means peace, prosperity and recognition of useful service well performed. It is in line with the broadening trend of economics as we

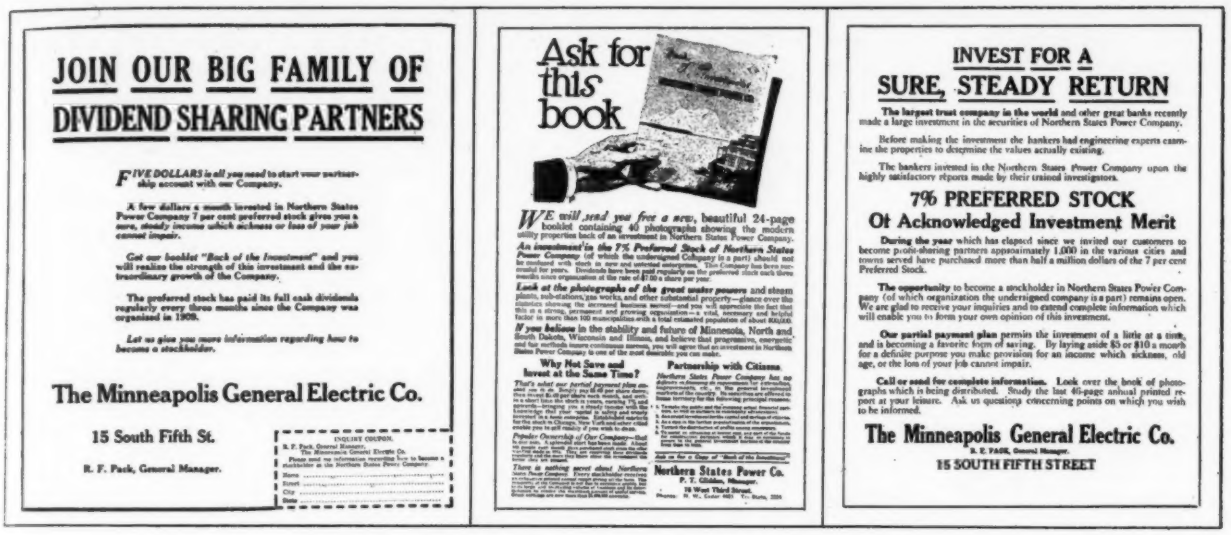


An Investment Opportunity
In One of Your Public Utility Properties

Take a Step Toward
Financial Independence

Partial-Payment Plan
Northern States Power Company
7% Preferred Stock

Three Newspaper Advertisements Used in Promoting Sales of Stock to Customers.


JOIN OUR BIG FAMILY OF DIVIDEND SHARING PARTNERS
FIVE DOLLARS is all you need to start your partnership account with our Company.
A few dollars a month invested in Northern States Power Company 7 per cent preferred stock gives you a sure, steady income which sickness or loss of your job cannot impair.
Get our booklet "Back of the Investment" and you will realize the strength of this investment and the extraordinary growth of the Company.
The preferred stock has paid its full cash dividends regularly every three months since the Company was organized in 1909.
Let us give you more information regarding how to become a stockholder.
The Minneapolis General Electric Co.
15 South Fifth St.
R. F. Pack, General Manager.
INQUIRY COUPON
Ask for this book
WE will send you free a new, beautiful 24-page booklet containing 40 photographs showing the modern utility properties back of an investment in Northern States Power Company.
An investment in the 7% Preferred Stock of Northern States Power Company (of which the undersigned Company is a part) should not be confused with stock in new and untested enterprises. This Company has been successful for years. Dividends have been paid regularly on the preferred stock each three months since organization at the rate of $7.00 a share per year.
Look at the photographs of the great water powers and steam plants, sub-stations, gas works, and other substantial property—glance over the statistics showing the increased business secured—and you will appreciate the fact that this is a strong, permanent and growing organization—a vital, necessary and helpful factor in more than 100 municipalities with a total estimated population of about 850,000.
If you believe in the stability and future of Minnesota, North and South Dakota, Wisconsin and Illinois, and believe that progressive, energetic and fair methods win continued success, you will agree that an investment in Northern States Power Company is one of the most desirable you can make.
Why Not Save and Invest at the Same Time?
Partnership with Citizens
Popular Ownership of Our Company—that is our aim. A splendid start has been made. About 10,000 people now invest their savings in our stock. Give an investment in our stock a chance to win your favor. Let us tell you more about it. Write today.
There is nothing secret about Northern States Power Company. Every stockholder receives a detailed report of the business each year. Back of the investment in our Company is our plan for extensive growth. The field is large, and we are now reaping a harvest of customers and the dividends which they bring. Back of the investment in our Company are more than $6,000,000 invested.
Ask us for a Copy of "Back of the Investment"
Northern States Power Co.
P. T. Gliddon, Manager.
70 West Third Street.
Phones: St. Paul, Main 4921 Minneapolis, Geyser 4921
INVEST FOR A SURE, STEADY RETURN
The largest trust company in the world and other great banks recently made a large investment in the securities of Northern States Power Company.
Before making the investment the bankers had engineering experts examine the properties to determine the values actually existing.
The bankers invested in the Northern States Power Company upon the highly satisfactory reports made by their trained investigators.
7% PREFERRED STOCK
Of Acknowledged Investment Merit
During the year which has elapsed since we invited our customers to become profit-sharing partners approximately 1,000 in the various cities and towns served have purchased more than half a million dollars of the 7 per cent Preferred Stock.
The opportunity to become a stockholder in Northern States Power Company (of which organization the undersigned company is a part) remains open. We are glad to receive your inquiries and to extend complete information which will enable you to form your own opinion of this investment.
Our partial payment plan permits the investment of a little at a time, and is becoming a favorite form of saving. By laying aside $5 or $10 a month for a definite purpose you make provision for an income which sickness, old age, or the loss of your job cannot impair.
Call or send for complete information. Look over the book of photographs which is being distributed. Study the last 46-page annual printed report at your leisure. Ask us questions concerning points on which you wish to be informed.
The Minneapolis General Electric Co.
R. F. PACK, General Manager.
15 SOUTH FIFTH STREET

Three Advertisements That Proved Successful in Selling Stock.

understand them today. It provides a simple and workable means to preserve the needful equilibrium between the producer and consumer; the natural and economical monopoly and the people.

Customer ownership will humanize the utility corporation and give the people a true understanding of corporate affairs. It will do the corporation just as much good as it does the public, and no more.

Where the Northern States Plan Is Different.

The chief points differentiating the customer ownership plan of the Northern States Power Company from similar undertakings are as follows:

(1) It represents a permanent policy.

(2) The stock is that of a holding company owning the stock of utilities operating in five states.

(3) Primary effort is put forth to secure the broadest possible distribution of stock among the greatest possible number of people.

(4) The plan is carried out to reach and interest the wage earner; in other words, the people.

(5) The partial-payment plan in effect is exceedingly simple, calling for the deposit of but $5 a share per month.

(6) The raising of capital for investment in the properties is a secondary consideration, the leading object being to secure customers as financial partners in the enterprise.

(7) The preferred stock has full voting rights and the owners are therefore entitled to a voice in the affairs of the company.

Efforts at Other Byllesby Properties.

Results at the Northern States properties have caused H. M. Byllesby & Company to adopt the general policy of selling securities in the home territory of the utilities managed wherever it is possible to do so. A few months ago the San Diego Consolidated Gas & Electric Company issued $144,000 seven-per-cent stock and offered it to the residents of that city. The stock was purchased by upwards of 100 residents within a short time. Reliance was placed almost entirely on four newspaper advertisements, which produced several hundred inquiries. Much more of the stock could have been sold were it available. It was offered on a partial-payment basis as well as for cash.

At practically all of the Byllesby properties where it has been possible some progress has been made in selling securities to customers. There are a few cities where the prevailing rates of investment return are so high as to preclude any considerable sale of the securities which we have to offer. One of the securities which has been advertised and found a considerable market at various properties is the six-per-cent gold notes of Standard Gas & Electric Company, which owns investments in all of the utilities under Byllesby management.

Difficulties of Public Utility Financing.

In June, 1915, when the experiment of selling stock at operating units was launched financial conditions throughout the United States were decidedly unsettled. It had been generally impossible for utility companies to finance large undertakings for two and one-half years, except through the issue of short-term coupon notes paying a high rate of interest on the cash received. The utilities, like other industries, had gone through a season of retrenchment and the careful husbanding of resources. Genreally speaking, every considerable improvement which could be postponed was put off for the time when capital could be more easily and cheaply obtained. Operating companies had studied economies and perfected efficiencies as never before. There were few men who care to predict that by the spring of 1916 financings of the largest kind could be accomplished easily and on conservative bases.

The Northern States Power Company had been put together gradually as properties were acquired from 1909 to 1912. It was and is a Delaware holding company, at that time owning the stock of many operating and intermediate units bearing different names whose funded debt represented a variety of separate bond and note issues. Not a single operating company bore the name of the parent corporation. It is safe to say that in June, 1915, not one citizen out of a hundred in the territory served was familiar with the name of the Northern States Power Company or knew anything about it or its stock, preferred or common. These stocks had been regularly quoted and enjoyed a good standing in the public utility markets of New York, Chicago and other large cities, but very little had been offered or purchased in the Central Northwest.

Before the decision was finally made and the plans shaped general conferences were held at which the resident managers were present and given full opportunity to express their opinions and suggestions. Without exception they were in favor of offering the stock and selling it direct to their customers from the offices of the company. Just how the public would receive the proposal was a question of some anxiety. No one connected with

the company felt sure whether the first overture would meet with praise or criticism and a vast amount of care was expended over the wording of the first advertisement and the first circular letter which the managers sent to their list of patrons.

Newspaper and Direct-by-mail Advertising.

Much of the foregoing information is presented at the risk of being tedious, but it seems essential to a proper understanding of the experience of this particular company in selling stock to its customers. The subject is one with many ramifications and the local conditions vary greatly. It is clear that each situation is a law unto itself and must be studied individually in order to make a success of interesting utility customers as financial partners.

After the initial advertisements and circular letters we continued to pound away steadily on our stock-selling plan. Each of the operating units regularly uses a certain moderate amount of newspaper space, and part of this has been used for advertising the preferred stock. The practice now followed is to use the regular space one full week each month at each property, eliminating the ordinary commercial advertising while the space is so employed. Circular letters, folders, etc., are also put out at intervals of about three months. Formerly some of these were mailed but now they are distributed by the meter readers, except at Minneapolis where they are placed in the same envelope in which the service bills are mailed. The other properties use the post-card form of billing. All of the circular matter carries unstamped return post cards. Most of the newspapers ads have inquiry coupons.

The reverse side of the cashier's stub is used as a means of advertising and producing inquiries. The attention of the customer is called to the advantages of the stock as an investment and he is told to "mark the square for complete information." By placing a mark in the square he automatically makes an inquiry, which is discovered by the cashier in running over the stubs at the end of the day. The cashier then writes out the name and address of the inquirer and sends it to the manager or proper department. The left one-third of the address side of post card bills is utilized in this manner. The number of inquiries received makes the practice well worth while. As many as a dozen inquiries on the stubs have been received in a day in the Minneapolis office. A few are filled by children and unauthorized people; the majority are from people really interested.

During the first few months of the campaign we felt the lack of a booklet illustrating and briefly describing the properties. About the time of the funded debt financing we issued a 24-page brochure, 7 by 8.5 inches in size, of rather unusual design. It bears the title "Back of the Investment," and contains about 40 photographs of the properties and cities served. It gives a brief summary of the properties, describes the policies of the company, has maps of the territory and transmission lines; statistics showing the growth of the electric connected load for five years; and gives a list of the communities served.

This booklet has been advertised as an inducement to inquiries. It is sent with follow-up letters and used by the managers and security representatives and has assisted greatly in getting people interested and giving them an idea of the size and character of the properties. Copies are available on the counters at all of the company's offices.

Newspaper articles describing the stock-selling plan, the progress of the company, its construction plans, extensions, improvements, etc., and reviews of the annual report are supplied the newspapers from time to time and printed as news matter.

The company is trying advertising on slides in motion-picture houses but has not yet secured data which show the results. In certain cities the company believes that it is productive, particularly so in places where for some reason or other newspaper advertising does not pull.

Experience With Partial-Payment Plan.

The partial-payment plan was inaugurated in August, 1915. It was our view that this feature would ultimately become the strongest factor of our plans, because it made available as financial partners the great majority of people who have small incomes and who seldom or never have sufficient cash in hand to purchase a single share of stock. At first the partial-payment offer seemed to meet with some indifference. The cash sales far outnumbered those made on deferred payments, not to exceed 15 per cent of the investors electing to pay on installments during the first 10 or 11 months. In May and June of the present year a special effort was made to direct attention to the time-payment proposition. Since that time the partial-payment plan has gained steadily in favor and there are now about 375 customers investing their money in this way. In June, July and August from 25 to 30 per cent of the sales, but not of the amount of stock sold, were on deferred-payment terms. The amount of stock sold on partial-payment is about 15 per cent of the total. It is believed that the proposition of partial-payment purchasers will steadily increase.

Partial-Payment Circular Used.

Reference has been made to special effort in the late spring of the present year to increase the partial-payment sales. One of the chief instruments employed was the following circular letter, with unstamped return post card inclosed, sent by the resident managers to customers:

Partnership.

To Our Customers:

We are again calling your attention to the opportunity afforded to become financially interested and a partner in this company.

You do not need a large sum of money to do this.

You can use this company as a medium for saving and investing at the same time.

The Northern States Power Company, of which the Minneapolis General Electric Company is a part, serves more than 81,000 customers in more than 100 separate communities.

When you pay $5 a month for preferred stock in this company you really pay the money to yourself.

In a comparatively short time you will have saved approximately $100 and will own a share of preferred stock which will pay you $7 a year cash dividends. While you are acquiring the stock you receive six per cent on your payments. If you withdraw your funds you receive three per-cent interest.

If you wish to invest $10 a month, buy two shares of stock; $15 a month, three shares, and so on up to 10 shares, which is the limit for a single subscription.

You are dealing with a large, responsible concern, which could not afford to treat you other than honorably and fairly.

Large banks, institutions and experienced investors eagerly purchase the securities of the Northern States Power Company. The preferred stock has paid 25 consecutive dividends regularly every three months since the organization in 1909.

It is not at all necessary for us to come to our customers for funds. We offer you partnership on the easiest practicable terms because we want to mutualize the ownership of this company, and to have our customers share in the wages paid to the capital employed in usefully serving them.

We certainly expect to add to the popularity of our company as more and more customers become partners and security owners. We are, therefore, giving you every opportunity to share in the reasonable earnings properly following efficient and progressive management and the expenditure of large amounts for physical property.

Please consider this matter carefully. Let us answer your questions and convince you that what

we propose is directly to your financial interest, and for the best interests of the whole community. Fill out the inclosed card if you do not have time to come and see us personally. You will be pleased with our new booklet, which we will send you promptly.

Necessity of Partial-Payment Feature.

The writer happened to be in Minneapolis late in June and inspected 200 cards which had been returned in that city as the result of the last quoted circular. The Securities Department had looked up the occupation of the inquirers so far as possible and noted the information on the cards. They came from people in every walk of life. The names of executives, business men, doctors, lawyers, clerks, college presidents, saloon keepers, school teachers, masseurs, railroad trainmen, housewives, laborers, skilled and unskilled—even bankers. The list was as cosmopolitan as could be imagined. Inasmuch as upwards of 60 per cent of the inquirers in Minneapolis make an investment in the preferred stock it is safe to say that the stockholders' lists are similarly representative.

If the object of selling stock to customers is to interest as many people as possible, the partial-payment feature is a cardinal necessity. This is true particularly in the smaller cities and the towns and villages. The demand for capital for investment in local enterprises in the small cities is as keen as in the large cities. Every hustling little city is trying to organize factories and raise money to help secure new industries. Co-operative enterprises have their stock solicitors on the streets of nearly every town, and every citizen with a dollar is besieged to put it in some local enterprise which needs capital. These conditions mean that a public utility company has to struggle hard for local investment in a small place, and the fact that outside sources have been furnishing all the capital for the public utilities makes the effort the more difficult.

The partial-payment plan is a savings proposition. It appeals to the wage-earner who is trying to be thrifty, but who has never been expected to place money in the different local enterprises and has not done so. It will interest many who have never put a dollar in a savings bank or a building and loan association. A large amount of stock in small lots may be sold for cash in good-sized cities and to a few well-to-do in small communities, but even in the large centers the partial-payment plan reaches out and offers something to the great majority to whom investment, dividends and interest are as fairy tales.

Follow-Up and Sales Methods.

When an inquiry is received the following letter is promptly forwarded:

Dear Sir:

We wish to thank you for your inquiry of..... and the interest you have in our new booklet "Back of the Investment," which we are sending you under this cover.

When you have looked through this booklet I am sure that you will be impressed with the modern, substantial and well-maintained character of these large properties, and will feel like investing in enterprises indispensable to the communities served, now numbering more than 100.

We trust you will thoroughly analyze the investment merit of the proposition in the light of the figures and information set forth in the company's complete annual report, and the descriptive circular which we are prepared to supply you. We know that the investment is thoroughly sound, and you can easily confirm our statement by a brief analysis.

Please let me know whether I shall send you copies of the last annual report and financial circular or whether you will call at my office, where I have all information at hand to answer any special questions upon which you may wish detailed information. If you can arrange to call, it probably would be more satisfactory than if I attempted to transmit the information by letter.

We are glad to receive either large or small investments in the seven-per-cent preferred stock, which may be purchased either for cash or on partial payments at the rate of $5 per share per month.

Please let me know whether you wish me to send the financial reports or whether you will call, and if so, at what time, so that I will be sure to be at the office.

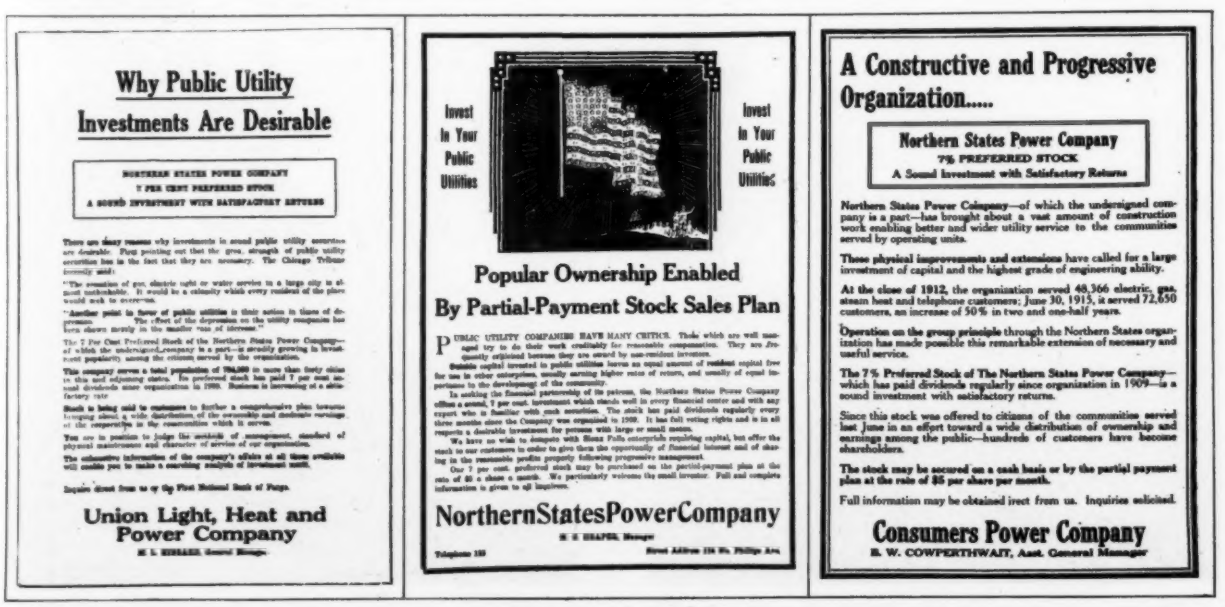
Again thanking you for your inquiry,

Yours truly,

.....

It is obvious that this letter endeavors to have the prospect call at the company's office, and a great many do this at a great saving of time to the company's manager and employees. In Minneapolis and St. Paul, where the Securities Department is maintained, the prospects are turned over to the securities salesmen; at the other properties they are taken care of personally by the manager.

In conclusion it may be suggested that by merely making the securities of a utility company easily available for investment by the local public, an act has been performed which gives the public a new and favorable impression of the company—one that is a considerable asset in itself and productive of friendship and good will.



Three Particularly Effective Advertisements Used in Stock Campaign.

Pole Lines of C. M. & St. P. Electrification

A Description of the Montana Power Company's Transmission-Line Construction and the Chicago, Milwaukee & St. Paul Railway Company's Trolley-Line Construction, With Comparative Costs on the Use of Wood Poles and Steel Towers

AMONG the many features of the electrification of the Rocky Mountain and Missoula divisions of the Chicago, Milwaukee & St. Paul Railroad and the power distribution system of the Montana Power Company, which furnishes energy for the operation of the trains, one of the most interesting is the pole-line construction. The magnitude of this work can be shown by the statement that in the electrification of 440 miles of main line, from Harlowton, Mont., to Avery, Idaho, approximately 38,000 poles were used in the construction of the power transmission system. This system includes the high-tension transmission line, the positive or outgoing feeder system, the overhead contact system and the negative or return system.

High-Tension Transmission Line.

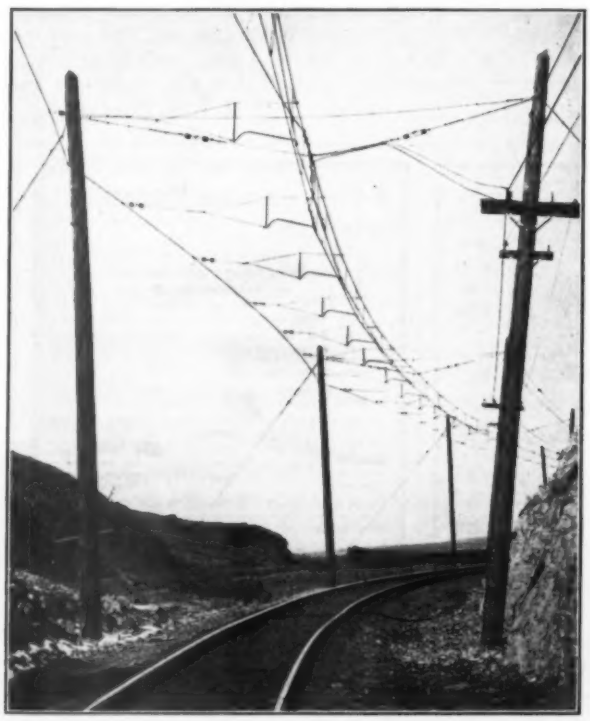
The Montana Power Company's transmission line transmits three-phase alternating current at a pressure of 100,000 volts. For the major part of the distance the line is located on the railroad company's right of way, and while this is convenient for inspection from trains and economical distribution of materials for construction and repairs, it was necessary and desirable in certain localities to erect the pole line outside of the right of way in order to effect a saving in distance or to avoid physical obstructions.

Poles of the best quality Western Red Cedar, purchased under usual specifications and inspected before being shipped, were used throughout. The standard sizes for the transmission line are 45 and 50 feet in length with eight-inch tops. Lengths between 45 and 80 feet were used to take care of grading the line and local conditions. The standard pole spacing for tanget work on level ground is 440 feet. This distance is varied to suit conditions as regards to curvature or topography of the country, in some sections it being necessary to make the spacing from 1,200 to 1,400 feet.

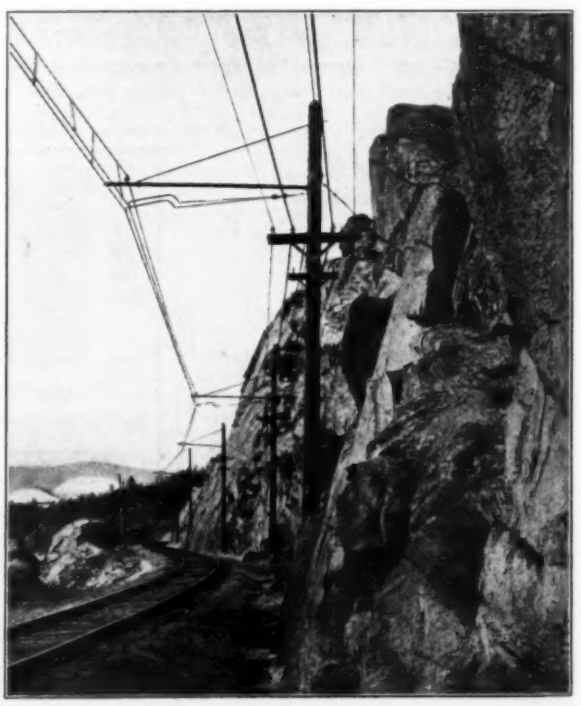
The crossarms used are Washington fir, with a cross section of 4.75 by 5.75 inches, and on tangent work they are braced by galvanized steel flats, 0.25 by 2 inches, fastened to crossarms with 0.625-inch carriage bolts and to poles with 0.625-inch lag screws. The crossarms are fastened to the poles with 0.75-inch bolts. On curve and angle work, including angles up to 10 degrees, the crossarms are offset to provide clearance between the wires and the poles, the amount of offset being dependent upon the degree of the angle or curvature. The crossarms are braced with angle irons. Drop brackets made of angle irons are used for insulator suspension on the ends of the arms protruding the most, while on the shorter side suspension is by means of crucible-steel castings with eyes. On angles between 10 and 30 degrees two poles are used with double crossarms and are heavily guyed. On angles greater than 30 degrees two poles are used, spaced far enough apart to maintain the proper distance between wires. One pole carries insulator suspensions for two wires and the other pole one insulator suspension. Both poles are heavily guyed, there being four separate guys for each pole.

Where the transmission line crosses the tracks or over telephone, telegraph or other power circuits, it is strengthened both mechanically and electrically as a matter of safety. The line is dead-ended and the type of construction shown in the accompanying illustration is used.

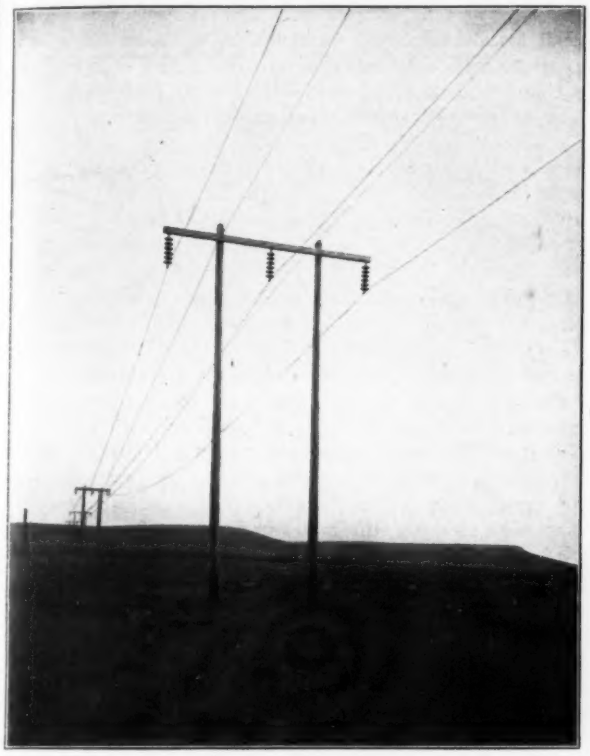
Where the spacing between poles is 450 feet or more, double crossarms are used and the poles are side-guyed. In marshy ground, or where poles are exposed to wash, standard poles are side-guyed and banked with rock.



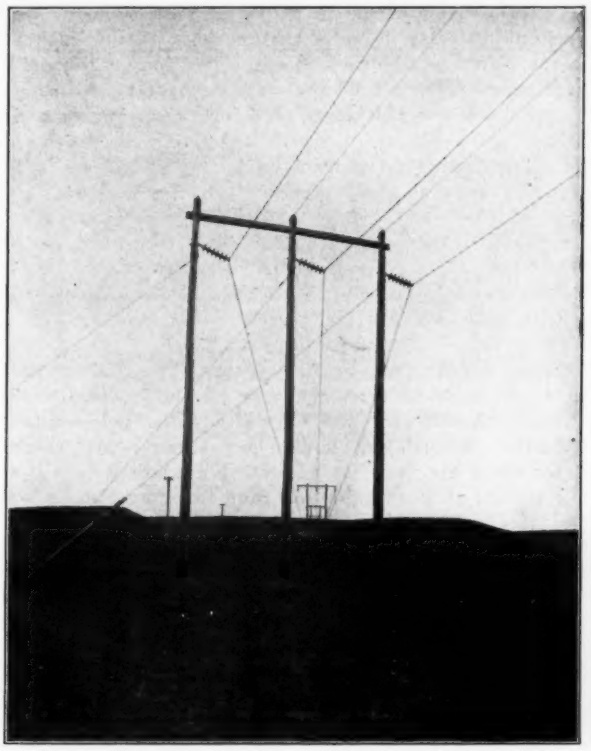
A 10-Degree Curve on the Chicago, Milwaukee & Paul Electrified Line.



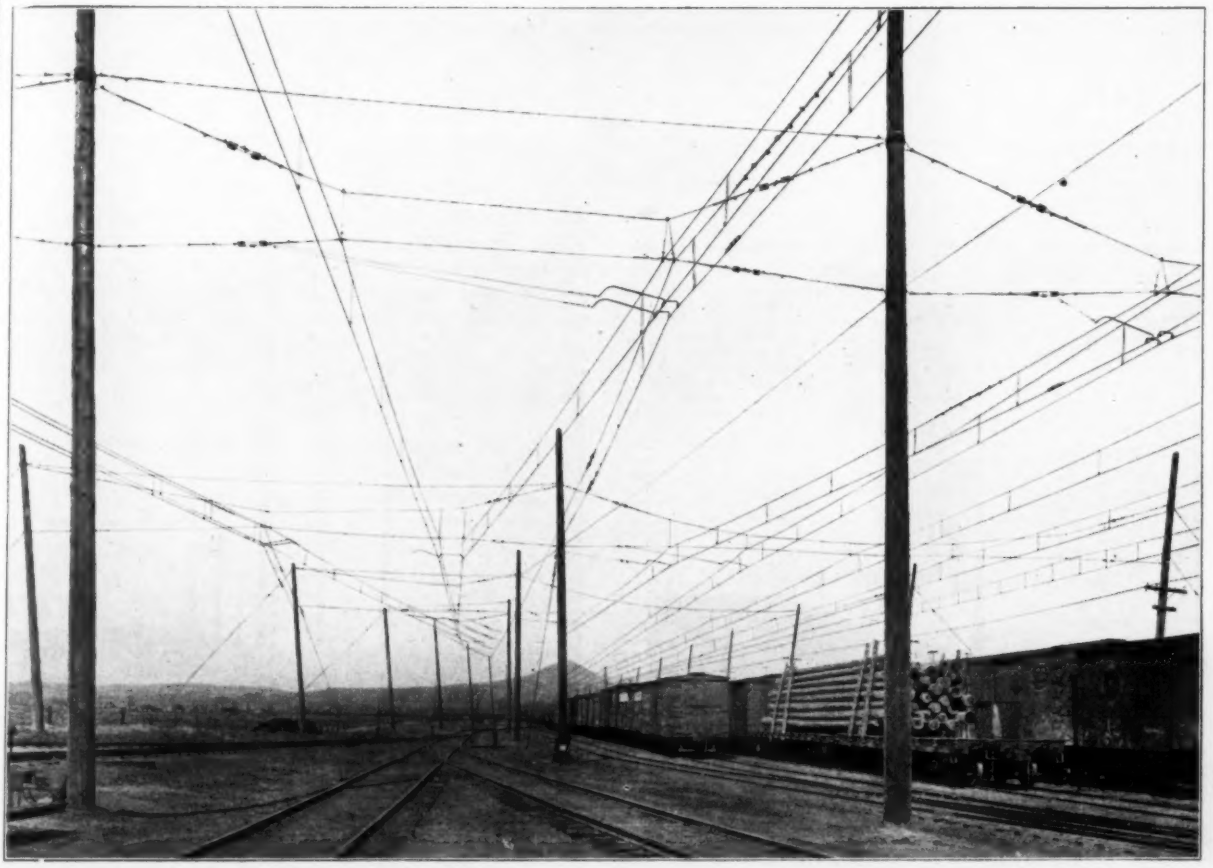
Pole-Line Construction on Curve on a Two-Per-Cent Grade.



Straight-Line Construction of Montana Power Company, Serving Chicago, Milwaukee & St. Paul Line.



Curve Construction Used by Montana Power Company, Serving Chicago, Milwaukee & St. Paul Line.



Overhead Construction in Butte Yards, Chicago, Milwaukee & St. Paul, 3,000-Volt Direct-Current Electrification.

The pole guys used are of three-eighths and three-fourths-inch steel strand wrapped around poles and secured with Crosby clips. Anchors are three-fourths or one-inch mild-steel rods, with timber slugs of nine inches minimum diameter and four to eight feet long, as conditions demand. Where solid rock was encountered a heavy steel eyebolt, securely set, was used instead of anchor rod and slug.

The disk or unit type of insulation is utilized. The single top type consists of a glazed porcelain disk, 10 inches in diameter, with annular ridges on the under side cemented to a malleable iron cap and pin with ball end. The hook is locked into the cap by means of a cotter pin and cannot be removed from the eyebolt or other attachment to pole without removing the cotter. The standard suspension insulator consists of six disks.

The suspension clamp is nine inches long and curved down at the ends to clear the wire. It is provided with two five-eighth-inch clamping bolts with a shim between the wire bolts. At anchorage and heavy strain points seven insulator disks are used for additional insulation, together with a special anchor clamp and four clamping bolts.

The three conductors each consist of six strands of No. 6 B. & S. gauge copper wires with a hemp core, the latter being saturated with perservative compound to make it impervious to moisture. The sag in conductors was carefully calculated for various lengths of spans and temperatures. The wire was strung with the aid of horses and was pulled to specified tension, the tension being checked by use of a spring balance.

Feeder and Contact Systems.

A single line of poles carries the positive or outgoing feeder system, the overhead contact system and the negative or return leads. The rails are also used as part of the return system.

Like those used in the erection of the transmission system, the poles are of Western Red Cedar, the standard length being 40 feet with eight-inch top. For the trolley work, lengths ran as high as 55 feet for spans in yards where a number of tracks are included. The standard spacing on tangent track for the trolley system is 150 feet. This spacing varies with the track curvature and special installations near switches, there being some spacings of 70 feet, but comparatively few below 90 feet. Spacing changes were made in multiples of 15 feet.

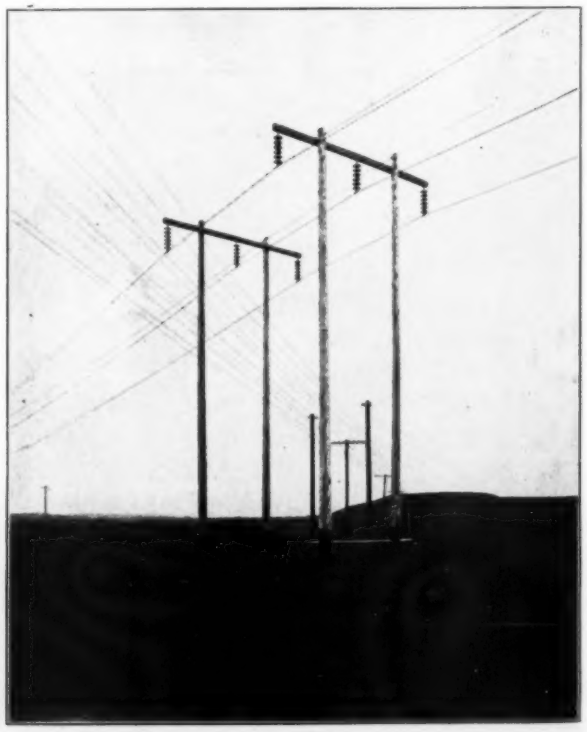
The crossarms are Washington fir, with a cross-section of 3.75 by 4.75 inches, and are fastened to the poles by means of 0.75-inch bolts and standard braces, 1.25 by 0.25 by 28 inches, the later being attached to the crossarms with 0.375-inch carriage bolts and to the poles with lag screws 0.5 by 5 inches. Crossarm pins are strenght-grained second-growth locust.

Wherever conditions permitted the bracket type of trolley-wire support was used, this type being preferable because of its appearance, of its offering the least obstruction to view from the locomotive, to its cheapness, and to the fact that it occupies the least space of any of the types used. On some curves and at points where there is more than one track, span construction is used. Where there are more than two tracks, two cross spans are used. The upper span carries practically the entire load, the lower span serving the messenger or trolley supporting wires and sustaining a part of the weight.

Trolley bracket arms are made up of 2.5 by 2.5 by 0.3125-inch "T" iron with a 0.6125-inch oversupport or truss rod and malleable castings for the attachment of truss rod to the arm and the arm to the pole. The latter casting is fastened to the pole by means of two lag screws. The truss rod passes through the pole and is secured by a nut and washer, the latter being large enough to give the full diameter of the pole for support. The pin for supporting the messenger insulator is malleable iron and clamped on the arm with a hook bolt. This method of attachment is cheap and effective and provides adjustment along the arm for centering the trolley wires.

In the span construction seven-strand galvanized-steel cable of a size suitable for the load carried is used. Attachment to the pole was made by two wraps around the

Dead-End Construction on Montana Power Company's High-Tension Line Serving Chicago, Milwaukee & St. Paul Line.



Type of Crossing Construction Used by Montana Power Company on High-Tension Line, Serving Chicago, Milwaukee & St. Paul Line.

Overhead Construction and Transmission Line Near Durant, Mont.

Overhead Construction and Transmission Line in Jefferson River Canon, Montana.

pole with shims between the strand. As in the transmission-line construction guys are seven-strand galvanized-steel cable and anchors are three-fourths and one-inch diameter, slugs being used for anchoring.

The positive feeders are of stranded bare copper cable, two sizes being used, one 500,000 circular mils and the other 750,000 circular mils. For the greater part of the distance a single cable of the smaller size is used, but on the heavier grades two feeders are required. The feeder is connected with the trolley wires at intervals of about 1,000 feet with bare copper stranded 250,000-circular-mil cables.

The overhead contact system consists of the messenger, which is attached to the bracket arm and supports the weight of the trolley wire through the hangers, the hangers and two trolley or contact wires, together with the necessary attachments for splicing, trimming and anchorage of both messenger and trolley wires. In some respects the contact system is a departure from former practice. The principle improvement is the use of two contact wires which hang side by side, and since the hangers are staggered there is always a flexible section of wire in contact with the current collector. This provides for the collection of a large amount of power at high speed without sparking. Such a flexible contact system takes care of troubles due to the inequalities in the track, movement in the locomotive body, and inertia of the adjustable contact device. The trolley or contact wires are free to move vertically and horizontally, giving a traveling contact wave in the wires with practically no change in weight or flexibility.

The messenger, which is 0.5-inch, high-strength, seven-strand steel cable, hangs in flat loops between the supports, the lengths of hangers being made to suit the location on the loops so that the trolley wires are practically level when pulled to the proper tension. The hangers are of 0.6125 by 0.125-inch steel looped over the messenger, which leaves the trolley wires free to move in a vertical plane. Clips fastening the hangers on the trolley wires are of malleable iron and fastened with a 0.5-inch bolt with lock washer. The entire hanger is sherardized for protection against rust.

The trolley wires are of hard-drawn copper, No. 0000 B. & S. gauge. At average temperatures the tension is about 1,300 pounds. The trolley wires are grooved so as to permit the use of mechanical clips which will clear the contact surface of the wire.

The negative or return system consists principally of the track rails, which are bonded together with bare copper cable 0.6125 inch in diameter. There is a supplementary negative return circuit which consists of a bare copper cable, No. 0000 B. & S. gauge, and which is attached directly to the tops of the trolley poles with no insulation. This cable is connected to the track rails at a large number of points by taps which are attached to the poles and covered with molding. The supplementary negative wire, being located above the positive feeder trolley and the signal wires, affords effective protection against lightning for these circuits.

On all "live" work in the system, there are two insulators in tandem, so if one should break, insulation will be maintained, under normal conditions, until replacement can be made.

Comparative Costs of Wood-Pole and Steel-Tower Construction.

Data has been prepared on the costs of two transmission lines erected by the Montana Power Company, one being of wood-pole construction and the other of steel-tower construction. The figures give the actual costs of the company's Great Falls-Butte steel-tower line and the East Helena-Josephine wood-pole line, both of which are similar lines as to carrying capacity and differ only in the supporting structures used. The steel towers are single-circuit towers with horizontal crossarms, and the pole structures consist of two 45-foot Western Red Cedar poles, with eight-inch tops, supporting a single horizontal crossarm. The comparative costs are given in the accompanying table and indicate a considerable saving by the use of wood-pole construction.

UNIT COST PER MILE OF WOOD POLE TRANSMISSION LINE. NO. 0 COPPER WIRE, 100,000 VOLTS.	
Supports	$ 203.80
Power wire	955.00
Ground wire	141.95
Telephone system	121.20
Power insulators	239.50
Power crossarms	29.45
Power hardware	28.75
Line switches	21.55
Creosote treatment	60.50
Clearing	30.80
Hauling	149.40
Digging	61.20
Framing	40.20
Setting	43.80
Stringing	87.50
Guying	21.38
Guarding	3.59
Survey	39.80
Camp	67.50
Tools	14.62
Hospital-injuries and damages	6.10
Roads	.13
General expense	55.00
Injuries during construction	.77
Total	$2,423.49

UNIT COST PER MILE OF STEEL TOWER TRANSMISSION LINE NO. 0 COPPER WIRE, 100,000 VOLTS.	
Towers	$ 615.38
Copper wire	955.00
Steel wire	141.95
Insulators	108.85
Hauling	181.33
Unloading	14.23
Digging	165.65
Setting	31.90
Assembling	77.17
Erecting	60.25
Stringing	117.52
Survey	20.40
Camp	122.33
Tools	28.71
Switches	115.38
Guying	46.24
Telephone	259.05
General expense	128.52
	$3,189.76

Abstracts of Illuminating Engineering Society Lectures

Illuminating Units and Calculations

By A. S. McALLISTER

THE more fundamental units and calculations used by the physicist have proven insufficient for the engineer and have been supplemented by others. The units candlepower, foot-candle, lumen, and lambert were explained. The photometric diagram for distribution from a source gives values for one plane only. If the distribution is symmetrical about a vertical axis, the total flux or the mean spherical candlepower may be determined by giving the proper weight to each zone according to its area. The Rousseau diagram furnishes a convenient graphical method for doing this, and its area is proportional to the total light flux from the source. The graphical construction of Kennelly gives this quantity as a linear dimension.

The brightness of a source is an important quantity. The mean spherical candlepower cannot be obtained, however, by multiplying the apparent candlepower per unit area by the total area. Hence the use of "apparent candlepower" may be confusing and it is preferable to use lumens per unit area. For a mat surface the ratio of the lumens of total flux to the apparent candlepower is equal to π. For any surface the ratio of the brightness in lamberts to the apparent candlepower per unit area is a definite constant. Hence it is not necessary to measure the candlepower of a restricted area when mean effective values are desired. A good conception of the value of the lambert is obtained from the relation that a surface radiating one lumen per square foot has a brightness of 1.076 millilamberts.

For the measurement of illumination the old point-by-point method of computation is complicated and has been superseded by short-cut methods. A good method is found by applying the principle that the lumens absorbed in a room must equal the lumens generated. Multiply each area in the room (floor, walls, etc.) by its coefficient of absorption and by the desired flux-density of light upon it and add together. This gives the total lumens which must be generated. The distribution of light will be determined by the choice and location of lamps. Another method of computation involves the utilization factor, or ratio of useful light to total light generated. Such factors must be estimated from similarity to installations for which they have been measured.

Modern Photometry

By CLAYTON H. SHARP

PROGRESS since 1910 is especially noticeable in physical photometry and heterochromatic photometry, both largely due to Ives. The physical photometer eliminates the physiological factor. This can be done by interposing in front of the source a screen whose transmission corresponds to the visibility of the eye for the different wave-lengths. Then any instrument for measuring total radiation may be used, such as a thermopile and galvanometer. It can also be done by a mechanical shield in front of the spectrum, the opening in the shield being proportioned to let different fractions of the different wave-lengths get through. The flicker method is preferred for color photometry and has been further investigated. After calibrating light filters or absorbing screens, these can be used in every-day comparisons, as between tungsten and carbon lamps.

Carbon lamps are retained as final standards, but tungsten lamps are probably more permanent, and give a whiter light for working standards. The gas-filled lamp has not reached the stage of development where it can be used as a standard, but this type may be used as a check lamp. Such lamps are calibrated by balancing against a vacuum lamp while using a screen. The variable factors of the Harcourt pentane lamp have been studied and the variation of candlepower with pressure, etc., determined.

The bridge method of adjusting a photometer comparison lamp consists of placing this lamp in one arm of a Wheatstone bridge. Since its resistance varies with current, the latter will have the correct value only when it has been adjusted so that the bridge is in balance. This method is used in portable photometers.

The integrating sphere photometer is immensely useful for measuring total light flux from a source. It is calibrated by the use of sources whose mean spherical candlepower is obtained by previous methods, involving many readings. Ulbricht gave the complete theory of this instrument, to which nothing has been added. It has been used as a portable photometer for measuring street-lighting units in position.

For measurements of illumination, the Macbeth illuminometer and other forms are available. A compensated transmitting test plate may be used. Measurement of the transmitting power of glasses presents difficulties, for if they are translucent the direction of the light is changed and an ordinary bar photometer does not suffice. Similarly with diffusing reflectors. Methods were described for each, such as the use of the Nutting reflectometer. In photometering projection apparatus, measurements should be made at the distance for which focused. When focused for an infinite distance, as searchlights frequently are, they may be measured at any distance.

Abstracts of Illuminating Engineering Society Lectures

Developments in Electric-Lighting Appliances

By GEORGE H. STICKNEY

THE developments since 1910 include increased efficiency, reliability, economy, adaptability, simplicity and convenience. These advantages have been accompanied by increased brilliancy of source, which is usually a disadvantage but is sometimes desirable. Of the types of electric lamps the tungsten lamp is now preponderant, the tantalum and Nernst types no longer being manufactured commercially. The use of carbon and Gem lamps is falling off rapidly. The old type of arc lamp is giving way to other illuminants. The open flame arc is being superseded by the inclosed flame arc and the metallic or magnetite arc.

Improvement in tungsten lamps has involved the drawn wire, coiling the filament, chemical exhaust and the gas-filled bulb. There have also been innumerable minor improvements giving lower cost, higher efficiency and greater uniformity of product. The filaments are now strong enough for all purposes. Coiling the filament has made possible the automobile headlight and the gas-filled lamps. The value of chemical exhausting is in eliminating water vapor. The "getter" changes the deposit on the bulb from black to a light color, thus reducing its absorption. The range in size has been immensely increased, running from the surgical lamp to types as large as are called for. The larger gas-filled lamps have required a change in fixtures in order to give ventilation. The bulb must also be protected from the weather as water is likely to crack it. This type is available in sizes from 75 to 1,000 watts. Tungsten lamps are available in the following types: decorative, tubular, candelabra, focusing, series street lighting (60 to 1,000 candlepower), street car (up to 94 watts), railway car (at special voltages), automobile, flash lights and Christmas tree.

The Moore or vacuum-tube lamp filled with carbon-dioxide gas is valuable for its color qualities and is used at the present time only in the alternating type for lighting small areas.

Arc lamps may be divided into open, inclosed, flame (both open and inclosed) and magnetite lamps.

The open arc lamp is now manufactured only for special purposes. Many series inclosed arcs are still in use for street lighting. A great variety of electrodes are available for the different arc lamps, and the arcs are more steady when used with proper electrodes. Flame arc lamps are the most efficient electrical illuminant. There was difficulty in inclosing the flame arc on account of the deposit. This was solved by the use of a condensing chamber and economizer. This lamp is used for industrial lighting (usually yellow flame with high efficiency) and for street lighting (usually white flame). Types are available for both direct and alternating current, but they are not interchangeable.

The magnetic lamp is an open-arc, direct-current lamp with a comparatively long life. It is less efficient than the flame arc, but gives considerably better electrode economy. The electrodes consist of copper and magnetite to which titanium and other materials may be added. The General Electric lamp has a heavy copper electrode above, while the Westinghouse type has a light copper electrode below, and is known as a "down draft" lamp.

Distribution curves and tables of wattage, efficiency, etc., were given for a number of different types of lamps.

Mercury-vapor lamps have low intrinsic brilliancy and are highly actinic, and are available for both direct and alternating current. The present types start with a quick break and static impulse. The quartz-tube type is available only for direct current at 220 volts and high wattage. An outer glass globe is used to cut off the ultraviolet rays. The candlepower of this lamp falls to 80 per cent of the initial value in about 2,000 hours, but a total life of 4,000 hours is claimed, while there are many in service which have had a much longer life.

Developments in Gas-Lighting Appliances

By ROBERT F. PIERCE

PROGRESS since 1910 consists principally in the elaboration of types then existing. The mantle made on artificial silk, which is much stronger than the cotton mantle, has been supplemented by the rag mantle in large sizes. The newer types of mantles give a maximum light flux with 1.25 per cent of ceria. Lamps have been made with as many as 30 mantles (five tiers of six each).

Ignition may be accomplished by means of an electric jump spark, or a spark made by a vibrator which is set in action by turning on the gas. The catalytic action of platinum black has been applied, and also a platinum wire heated by electric current.

Pilot flames are usually provided for the larger gas-lighting units. They must be protected from tar, scale, etc. The latest form uses only 0.04 cubic foot per hour and is not easily blown out. Pilot flames are often used for low illumination.

Distant control is realized by means of special cocks and pneumatic or electromagnetic operation.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

New Lighting Contract Being Considered in Denver.

A new contract for lighting the city of Denver, Colo., by the Denver Gas & Electric Company, is now being considered, the contract having been referred to the Committee of Public Utilities by the City Council. A saving of $36,000 a year, it is estimated, will be made over a period of 10 years under the terms of the new contract. The term begins June 1 last and covers municipal lighting alone.

Under the new contract the cost of each arc lamp will be $50 and each incandescent lamp $20 a year, as against $60 and $30 respectively under the old contract. Lamps used from dusk to midnight will cost $1.75 per lamp per month.

The electric company will install lamps and equipment upon direction by the mayor, and standards will be furnished by the city, under supervision of the city electrician, with provision for arbitration in case of dispute. Repairs will be made to defective or broken lamps the night the defect is discovered and the company agrees to maintain the efficiency of the lighting system and hold the city harmless for suits growing out of its negligence.

Effect of Voltage Variation on Lamp Performance and Cost.

It is well known that as the voltage applied to an incandescent lamp departs from the normal, there is a still greater departure in both wattage and candlepower. If the resistance of the filament were constant, the watts would vary twice as fast as the voltage. Owing to the fact that resistance changes with temperature and the filament temperature changes with applied voltage, the wattage of a tungsten lamp varies less rapidly than twice the voltage, but yet more rapidly than the voltage. The life of the lamp is markedly affected by any departure from normal operating voltage. Table I shows the variation of the different factors, expressed in percentage of the normal or rated values, as given by Middlekauff and Skogland.

TABLE I.—EFFECT OF VOLTAGE VARIATIONS ON TUNGSTEN LAMPS.

Volts Per cent	Candlepower Per cent	Watts Per cent	Watts per Candle Per cent	Current Per cent	Life Per cent
95	83.1	92.2	111.0	97.0	216
96	86.3	93.7	108.7	97.6	185
97	89.6	95.3	106.3	98.2	158
98	93.0	96.9	104.2	98.9	136
99	96.4	98.4	102.0	99.4	117
100	100.0	100.0	100.0	100.0	100
101	103.6	101.6	98.0	100.6	86
102	107.4	103.2	96.1	101.2	74
103	111.2	104.8	94.2	101.8	64
104	115.1	106.4	92.5	102.3	56
105	119.0	108.0	90.8	102.8	49
110	140.3	116.3	82.9	105.7	25

Operation of lamps at voltages lower than normal decreases the revenue of the utility company and produces less light. At the same time it increases the cost of light per lumen-hour to the customer, owing to the increased specific consumption (watts per candle) of the lamp, at customary prices per kilowatt-hour. Operation at voltage higher than the rated voltage will increase revenue, give more light and decrease the cost of light per lumen-hour. It also decreases the life of the lamp. There is some price of energy at which the saving in improved efficiency is balanced by the cost of more frequent lamp renewals. At a rate of 10 cents per kilowatt-hour, however, it is more economical to burn lamps at excessive voltage, as shown by Table II, prepared by the Lamp Committee of the National Electric Light Association. There is a slight discrepancy in the values for candlepower in Tables I and II.

TABLE II.—COST COMPARISON.

Cost based on list price of 60-watt Mazda lamps and current at 10 cents per kilowatt-hour.

Volts Per cent	Watts Per cent	Candlepower Per cent	Total Cost of Light Per cent
96	93.7	86.7	105.1
97	95.3	89.9	103.7
98	96.9	93.2	102.3
99	98.4	96.5	100.9
100	100.0	100.0	100.0
101	101.6	103.5	99.1
102	103.2	107.2	98.1
103	104.8	110.8	97.3
104	106.4	114.6	96.7

Electric Iron As Premium in Louisville Co-Operative House-Wiring Campaign.

The Louisville Gas & Electric Company, which has been conducting a campaign for the wiring of already built houses for a period of more than two years is now arranging to prosecute the campaign more vigorously than ever in conjunction with the contractors, between now and the first of January. It is proposed to secure 1,000 contracts for this class of business in the period named, and a six-pound electric flat iron is to be given free with each such order secured. The company will devote its regular advertising space to the subject of house wiring exclusively and in addition the contractors will advertise independently.

Impressive House-Wiring Advertisement by Boston Company.

Herewith is reproduced a forceful street-car advertising card which sets forth the number of houses wired at Boston under the Edison Company's easy-payment plan. The

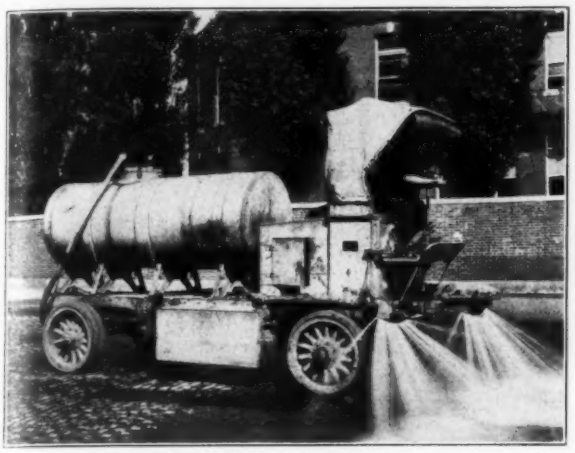
Impressive House-Wiring Advertisement.

number to date, 3,839, is an impressive one, and shows the public that electricity is synonymous with progress.

On either side of the text matter, which points out the salient features of the plan—no annoyance, no injury to woodwork, ample times for payment and no interest charges, are pictures of houses that have been wired.

Electric Street Sprinklers Operated in Boston.

Six electric street sprinklers are operated in Boston by a contractor working under the direction of the Street Department. They consist of a 3.5-ton General Vehicle Company chassis, on which is mounted an 800-gallon water tank. The sprinkler heads are in front of the vehicle, instead of behind, this arrangement giving the driver better control and understanding of the requirements of the moment than when the sprinkling apparatus is out of sight.



Electric Street Sprinkler Used in Boston—There Are Six of This Type Now in Service in the Hub.

The battery equipment consists of the 19 M. V. ironclad Exide, which is charged under the Boston Edison Company's charging service on a mileage basis of cost.

Plans for Appliance Campaign at Cambridge, Mass.

The Cambridge (Mass.) Electric Light Company on August 1 put in effect a reduced rate for domestic cooking, heating, washing, ironing, and small single-phase motors, of three cents per kilowatt-hour, on a separate meter, available to any customer whose demand does not exceed five kilovolt-amperes. The minimum bill is $1 per month. Heretofore, the rate for this service has been five cents per kilowatt-hour.

In conjunction with the reduction, the Cambridge company is planning a systematic campaign for the introduction of household heating, cooking and power equipment. W. E. Holmes, treasurer and general manager, is chairman of the Cambridge committee formed to promote the various uses of electricity in conjunction with the coming America's Electrical Week. It is planned to advertise on a large scale the economy and convenience of electricity for the household uses mentioned, and dealers will be asked to push the sales of all utensils. It is expected that local contractors will advertise special wiring required to secure the three-cent rate.

While the Cambridge company conducts no appliance store, employees of the company sell a large number of domestic appliances, being paid a commission on all sales, even if secured during working hours. Meter and lamp men, who come in close contact with the customers, are especially successful in securing this bonus, one employee earning about $5 per week from this source, in addition to his regular wages.

While the mere fact of there being a low domestic-appliance rate will undobutedly greatly stimulate sales, the one-dollar minimum will tend to encourage the installation and use of more and larger units. For example, a customer using two or three small devices consuming say 20 kilowatt-hours per month, or 60 cents' worth of energy at three cents per kilowatt-hour, will see that he may as well install another "current consuming" device. This will lead to the purchase of ranges, table stoves, washers and refrigeration systems.

Texas Company Adopts Method to Encourage Power Customers to Watch Meters.

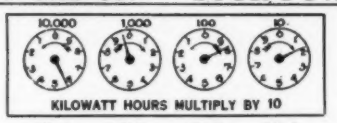
The Texas Power & Light Company is furnishing power this year for almost 100 cotton gins in central Texas. Service at 2,200 volts is furnished these gins at a net rate of 3.5 cents per kilowatt-hour.

In order to get the ginners interested in making a low record cost per bale for power, the company has had printed a number of cards, as shown in the accompanying illustration. As will be noted, these cards explain how to read the meter and also provide a space not only for the meter reading, but also for the power used, cost of power, bales ginned and cost per bale. Horizontal lines are provided for every day in the week. There is room on the card for five weeks' reeadings. At the end of the month the ginner can add up his "cost of power" column and obtain his monthly bill.

Before having the cards printed, a number of ginners were consulted and it was at their suggestion that a separate card for each month's operation was provided. The first cards are handed to the ginners by the district manager or by one of the commercial men. Cards for future months are distributed by the metermen on their monthly rounds.

It is hoped that these cards will tend to make the ginner watch his meter more closely, with the result that he will not let his motors run when the gin machinery is idle.

KEEP TAB ON YOUR POWER



NO. 4 NO. 3 NO. 2 NO. 1

Dial No. 1 reads from 0 to 10 It now reads 1
" " 2 " " 10 to 100 " " " 90
" " 3 " " 100 to 1,000 " " " 900
" " 4 " " 1,000 to 10,000 " " " 5,000

Meter reading THE ABOVE DIALS NOW READ 5,991
Kw-hrs.—5991×10= 59,910
If the reading yesterday was 59,500

The power used would be 310 kw.-hours

Be sure to multiply meter reading by constant marked on dial (shown above in red). This may be 1, 10 or 100, according to the capacity of the meter.

Day of Week	Meter Reading	Power Used K. W. H.	Cost of Power at 3c net	Bales Ginned	Cost per Bale
Mon.					
Tue.					
Wed.					
Thu.					
Fri.					
Sat.					
Mon.					
Tue.					
Wed.					
Thu.					
Fri.					
Sat.					
Mon.					
Tue.					
Wed.					
Thu.					
Fri.					
Sat.					
Mon.					
Tue.					
Wed.					
Thu.					
Fri.					
Sat.					
Mon.					
Tue.					
Wed.					
Thu.					
Fri.					
Sat.					
Totals for the month					

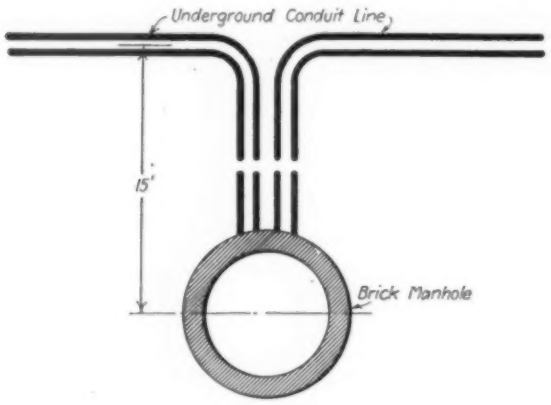
Card Furnished by Texas Company to Encourage Meter Reading by Customers.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Salvaging Abandoned Old Cable Proves Profitable.

A very interesting case of the recovery of a considerable amount of lead-covered cable, which had not been in use for many years and had been forgotten, recently occurred in Lincoln Park, the great public pleasure resort on the north side of Chicago. In making some excavations for water pipes, the workmen ran across a buried 2.5-inch steel pipe containing four cables, of which every one connected with the Electrical Department had forgotten. It was paraffined cotton-insulated lead-covered cable which was used to supply current to the Yerkes electric fountain that was a very popular feature of the park in the middle nineties. This fountain had been installed shortly after the World's Columbian Exposition, at which electric fountains were a prominent and spectacular feature of the electrical display. As the novelty of the fountain wore off it was operated less and less frequently and finally entirely abandoned some 18 years ago.



Old Construction Method In Which Manholes Were Formerly Set Off Some 15 Feet From Underground Conduit Line.

The cable recovered was found to be in apparently excellent condition, although it had been buried for such a long time. About 12,000 feet of cable was recovered. It was proposed to use this cable to good advantage in new construction work in the Lincoln Park system, extensions to the lighting circuits of which are continually being made. However, upon being tested at 7,000 volts it broke down consistently and was therefore junked. It is evident that the pioneers in cable building did not consider a large factor of safety essential. A profit of several hundred dollars was realized in the junk on account of the present high values of copper.

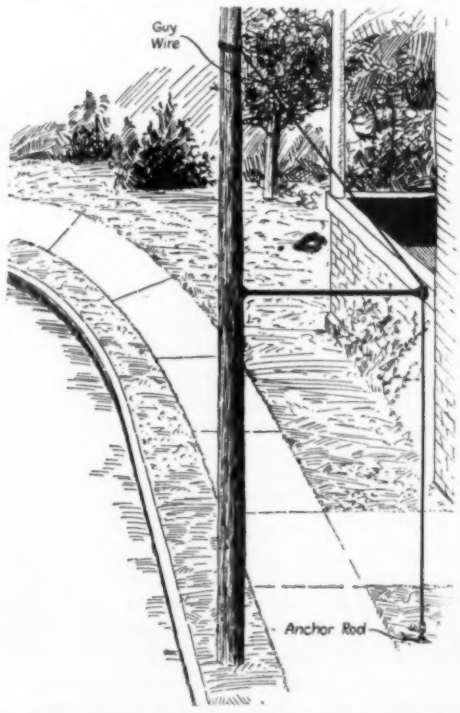
A peculiar feature of this old conduit installation was the practice of installing the manholes some 15 feet away from the main line and connected to the conduits by means of elbows, as shown in the accompanying diagram. Only one splice was found in this old cable, the splice itself being little larger than the cable and showing excellent workmanship.

Following an investigation by C. H. Shepherd, electrical engineer in charge, the Lincoln Park circuits have been so re-arranged as to release some 50,000 feet of excellent modern cable, which is being pulled out and used on the large amount of new construction work now being done by the Lincoln Park Electrical Department, thus effecting a marked economy on account of the exceptionally high price of cable now prevailing and the difficulty of getting reasonably prompt deliveries.

To Avoid Obstructive Guying.

Very often it is impossible to place a guy wire on electric light or telephone poles and get the proper tension without trespassing on private property; it is also at times inconvenient to have the guy cross a walk in close quarters without interfering with pedestrians, which is especially true at curves.

The method illustrated herewith solves both problems. Drill the pole at proper height to fit securely a piece of pipe complete with a tee. The guy should be brought down through the opening of the tee and fastened to the anchor in the usual manner. If the pole is not very thick, it is better to place a flange on the end of the pipe and securely fasten it against the pole, as shown, as this avoids weakening the pole by drilling almost entirely through it.



Method of Disposing of Guy Wire to Avoid Obstruction to Pedestrians or Objectionable Encroachment on Private Property.

J. C. Grindell.

Polyphase Motor Windings—IX

By Justin Lebovici

Previous installments of this article have dealt with two-layer windings, lap and wave windings of the closed and open types being discussed in great detail and elucidated with numerical examples and illustrations. The present installment discusses single-layer windings, giving examples and illustrations. Further installments will take up windings for two speeds, mechanical design and insulation.

WINDINGS WITH ONE COIL PER SLOT.

Since we have previously given a rather detailed discussion of the two-layer polyphase windings, the simplest treatment of the windings having one coil side per slot will be to consider these windings as two-layer windings of half the number of slots. Any number of slots, which is suitable for a winding having two coil sides per slot (considered in the previous

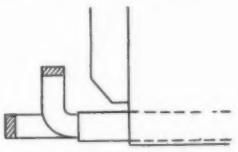


Fig. 104.

installments) when multiplied by two gives us a number of slots suitable for a winding with one coil side per slot.

Concentric Windings.

This type of winding is especially advantageous for high-voltage machines of large outputs. The heads of the winding are more easily anchored than in the case of the two-layer

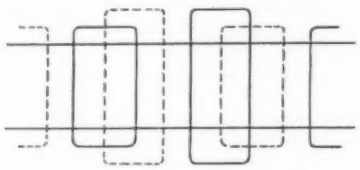


Fig. 105.

lattice type, and the distorting forces, caused by short-circuits on the line, are smaller in value.

Two-phase concentric windings may have the coils arranged in two tiers as shown in Figs. 104 and 105. In this case two differently shaped formers, and as many formers of one type as there are coils per pole per phase, are required. The type of winding shown in Figs. 106, 107 and 108 requires only one former.

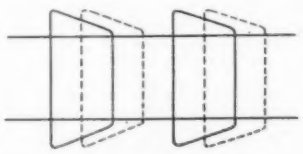


Fig. 106.

Three-phase chain windings may have the coils arranged in three tiers as shown in Figs. 109 and 110, or in two tiers as shown in Fig. 111. A scheme similar to that of Fig. 106 may also be used in order to reduce the number of formers required.

A two-tier, three-phase winding requires a skewed coil when the number of pairs of poles is an odd number. In some cases

Fig. 107.

the number of slots can be changed so as to make possible the use of a fractional number of slots per pole per phase and thus avoid the skewed coil.

Example No. 42.

A 10-pole machine has 30 slots, and is to be wound with a three-phase, two-tier concentric winding. We have

$$Z=30 \quad n=3 \quad p=5$$
$$q=Z/2pn=30/2\times5\times3=1$$

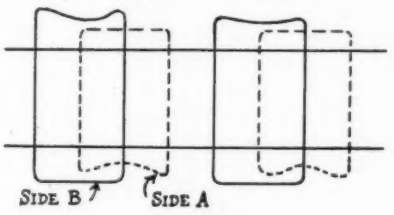


Fig. 108.

The winding diagram is shown in Fig. 112 and the coil A_1 A B B_1 is the skewed coil. We may avoid the use of a skewed coil, reduce magnetic losses and higher harmonics by using a different number of slots, giving us a fractional number of slots per pole per phase. The following examples show how this may be done.

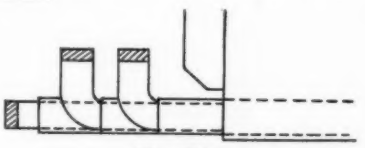


Fig. 109.

Example No. 43.

A 10-pole machine has 36 slots, and is to be wound with three-phase, two-tier concentric winding. We have

$$Z=36 \quad n=3 \quad p=5$$
$$q=Z/2pn=36/2\times5\times3=1+1/5$$

With one coil per slot, the winding will be balanced if the numerator of the fraction $(Z/4p)$, when reduced to its lowest terms, is a multiple of n. This follows immediately if we consider every other slot as taking the place of the bottom coil in a two-layer winding.

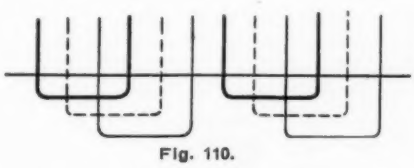


Fig. 110.

In our example

$$Z/4p=36/4\times5=9/5$$

and the numerator of $Z/4p$, reduced to its lowest terms, is a multiple of $n=3$. Hence the winding will be balanced if the coils are properly interconnected. Using the same notation as with the two-layer windings we have

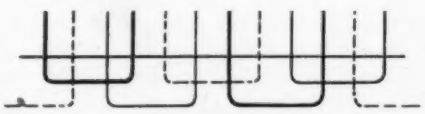


Fig. 111.

$$q=W+N/K=1+1/5$$
$$W=1 \quad N=1 \quad K=5$$

There will be N groups of $(W+1)$ coils per group and $(K-N)$ groups of W coils per group in each repeating winding section; hence we can write the Table XLII.

TABLE XLII.

Pairs of Poles	Phases I	II	III
1	ab a' b' 2	bc 1	cd 1
2	de 1	ef 1	fg f' g' 2
3	gh 1	hk 1	kl 1
4	lm 1	m' m' m n 2	no 1
5	op 1	pq 1	qr 1

This table can be used in drawing the conductor diagram of Fig. 113, which can then be completed as shown in Fig. 114. In drawing Fig. 113 only every other slot is used. The even-numbered slots are considered as the other coil side and are taken care of when completing Fig. 113 to make Fig. 114 by

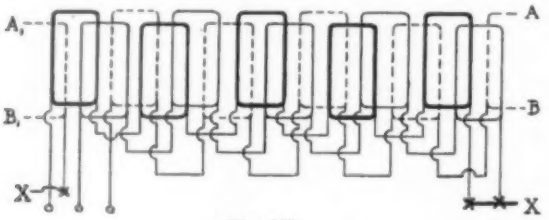


Fig. 112.

the connecting, for example, of coil side 1 to coil side 4 to make one complete coil.

It has been previously explained that in drawing the winding potential diagram it is enough to consider one coil side only,

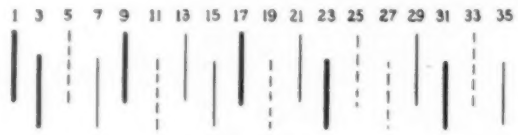


Fig. 113.

since the voltage per coil can be obtained by multiplying the voltage per conductor by a proper factor. This has been done in Fig. 115, which represents the winding potential diagram for Fig. 114. The vectors in Fig. 115 and Table XLII are indicated by the same letters and can readily be identified. The resultant vectors, representing the voltage per phase, are given to some scale by vectors *AB, CD, DE,* or by vectors I, II and III. It will be noted that the phases are balanced as to voltage and phase displacement.

In laying out Fig. 115 it is necessary to keep in mind the fact that we have 36/5 slots per pair of poles and hence we must divide the circle into 36 equal parts, 5 consecutive divisions giving the voltage of one slot.

From Fig. 115 it can be seen that the 10-pole winding with

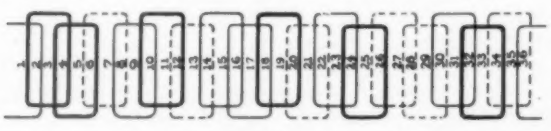


Fig. 114.

1+1/5 coils per pole per phase is equivalent to a two-pole winding having six slots per pole per phase. The resultant voltage is smaller than for the case of a winding of the same number of slots but a whole number of slots per pole per phase. The winding-factor of a machine with one slot per pole per phase is 1.0, while the winding-factor of the machine with 1+1/5 slots per pole per phase in a 10-pole machine, or 5 slots per pole per phase in the equivalent two-pole machine,

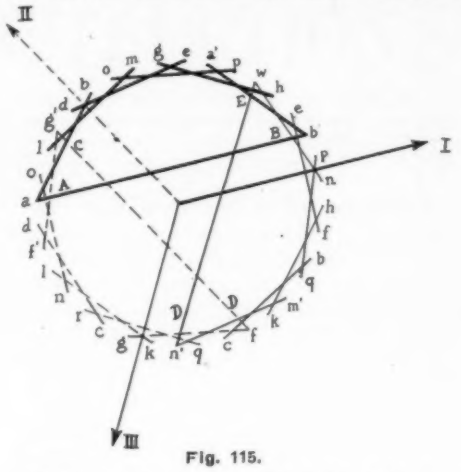


Fig. 115.

is 0.956, and the resultant voltage is reduced in the ratio of 0.956 to 1.0.

Example No. 44.

A four-pole machine with 30 slots is to be wound with a three-phase concentric winding. We have

$$Z=30 \quad n=3 \quad p=2 \quad q=30/12=2+1/2=W+N/K$$
$$Z/4p=30/8=15/4 \quad W=2 \quad N=1 \quad K=2$$

Since the numerator of $Z/4p$, reduced to its lowest terms, is a multiple of n, the winding will be balanced. Using the rules previously given we see that the winding repeats itself after two groups. One of these two groups will have three coils and the other will have two coils. We can then write Table XLIII.

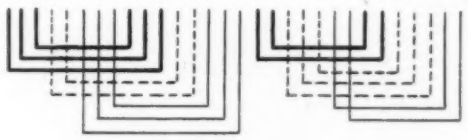


Fig. 116.

The coils can be arranged in three tiers as shown in Fig. 116.

Basket Windings are used in the stators and rotors of small, low-voltage, induction motors having semi-inclosed slots, where the coils consist of a large number of small wires. This type

TABLE XLIII.

Pairs of Poles	Phases I	II	III
1	3	2	3
2	2	3	2

of winding is advantageous, due to the saving in slot insulation space and the fact that the number of coils to be handled is reduced to half that of the two-layer lap winding.

If we number the slots consecutively, as shown in Fig. 117, we can consider the odd-numbered slots as corresponding to the upper layer of a two-layer winding and the even-numbered

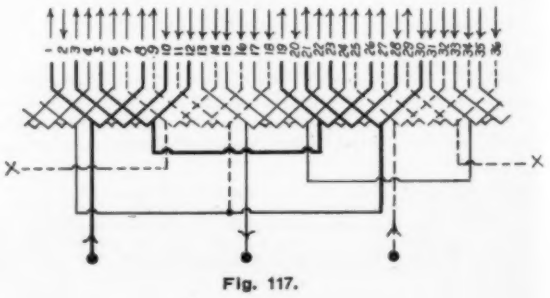


Fig. 117.

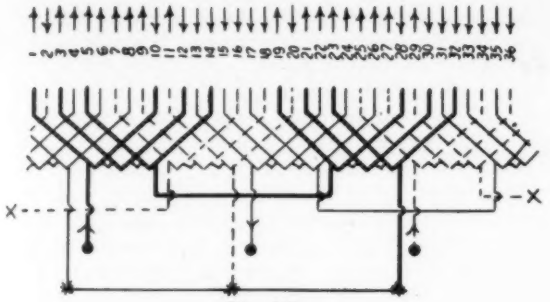


Fig. 118.

slots as corresponding to the bottom layer. We can then apply all the rules previously developed in connection with two-layer windings.

Example No. 45.

A four-pole machine having 36 slots and 18 coils is to be connected to form a three-phase, star, basket winding. We have

$$Z=36 \quad p=2 \quad Q=Z/2p=36/4=9 \quad n=3$$
$$q=Z/2pn=36/12=3$$

For a full-pitch winding the coils will be in slots 1 and 10. Applying the rules developed in connection with lap windings we have

$$y_1=9 \quad y_2=7 \quad y=+2$$

and we can write Table XLIV. The three phases are indicated by a heavy line, a dotted line, and a light line. Fig. 117 gives the complete winding diagram. For a short-pitch winding we will similarly have

$$y_1=7 \quad y_2=5 \quad y=+2$$

and the complete winding diagram is given in Fig 118.

TABLE XLIV.

——	1	10
——	3	12
——	5	14
- - - -	7	16
- - - -	9	18
- - - -	11	20
——	13	22
——	15	24
——	17	26
——	19	28
——	21	30
——	23	32
- - - -	25	34
- - - -	27	36
- - - -	29	2
——	31	4
——	33	6
——	35	8

Example No. 46.

An eight-pole machine having 36 slots and 18 coils is to be connected to form a three-phase, star, basket winding. We have

$$Z=36 \quad p=4 \quad n=3 \quad Q=Z/2p=36/8=4+1/2$$
$$q=Z/2pn=36/24=1+1/2 \quad Z/4p=36/16=9/4$$

The numerator of $Z/4p$, reduced to its lowest terms, is a multiple of n; hence the winding will be balanced if properly connected.

Since $q=W+N/K=1+1/2$ we have $W=1$, $N=1$, and $K=2$,

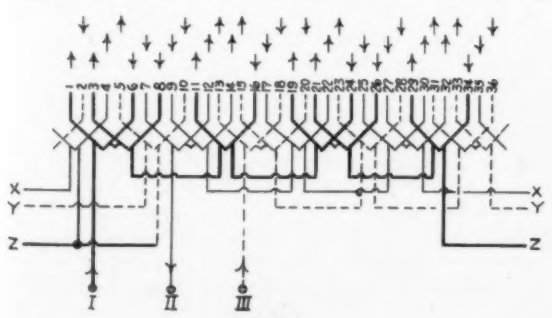


Fig. 119.

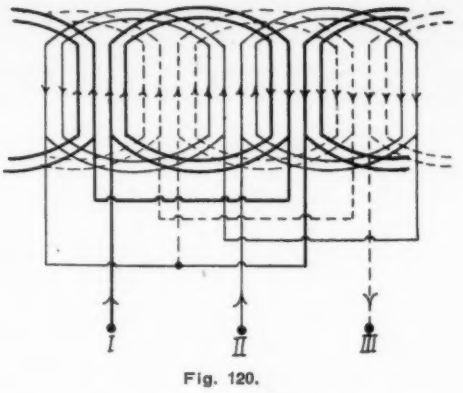


Fig. 120.

and there will be one group of two coils and one group of one coil in each repeating section, as indicated in Table XLV.

TABLE XLV.

Pairs of Poles	Phases I	II	III
1	2	1	2
2	1	2	1
3	2	1	2
4	1	2	1

Since $\tau=Z/2p=36/8=4+1/2$, we shall choose $y_1=5$, $y_2=3$, and $y=+2$ and arrange the coils per Table XLVI and Fig. 119.

Since 4.5 slots correspond to 180 electrical degrees, 3 slots will correspond to 120 degrees and the leads I, II and III in Fig. 119 will be brought out from points 3 slots, or a multiple of 3 slots, apart.

TABLE XLVI.

——	1	6
——	3	8
- - -	5	10
——	7	12
——	9	14
——	11	16
- - -	13	18
- - -	15	20
——	17	22
——	19	24
——	21	26
- - -	23	28
——	25	30
——	27	32
——	29	34
- - -	31	36
- - -	33	2
——	35	4

Single-layer lap windings with lattice end connections can be treated in the same way as the basket windings.

Skein windings are used only in small, low-voltage motors. A three-phase winding of this type is shown in Fig. 120 for the case of a two-pole, 24-slot machine with 12 coils.

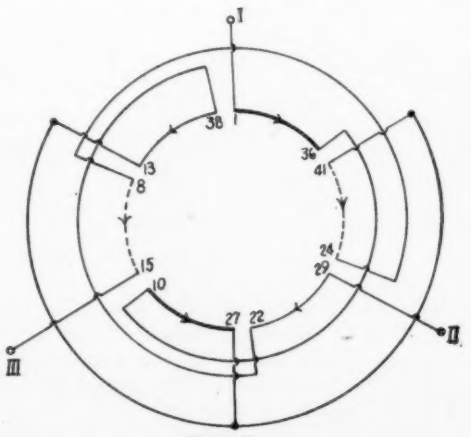


Fig. 121.

Wave Windings With One Conductor Per Slot.

In this case we regard an odd and an even slot as one unit corresponding to a slot in the case of a two-layer winding and apply the rules given in connection with two-layer windings.

Example No. 47.

Assume an eight-pole machine having 42 slots, 42 conductors, to be connected to form a three-phase, single-star, wave winding. We have

$$Z=42 \quad p=4 \quad n=3 \quad S=42$$

Now $Z/2=$ (a whole number $\times$ pairs of poles) $\pm a$ or $21=5\times4+1$

$a=1$

and $Z/2=$ (a whole number $\times$ phases)

or $21=7\times3$

$y_1=(21\pm1)/4=5$

We choose $y_1=y_2=5$ and write Table XLVII, consisting of

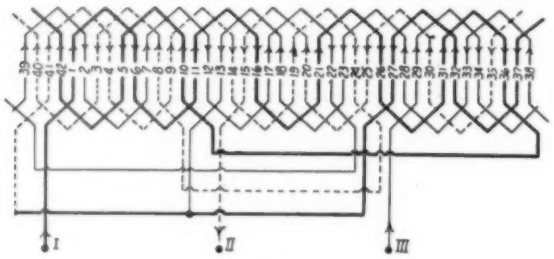


Fig. 122.

eight vertical columns and six horizontal lines, the difference between the figures in the vertical columns being alternately y_1 and y_2, while the difference between two figures in two horizontal lines is equal to $2a$.

TABLE XLVII.

(1)	6	11	16	21	26	31	(36)
(41)	4	9	14	19	(24)	(29)	34
39	2	7	12	17	(22)	(27)	32
37	42	5	(10)	(15)	20	25	30
35	40	3	(8)	(13)	18	23	28
33	(38)						

Since 42 conductors divided in 6 groups would give 7 conductors per group and we do not want the leads on both sides of the machine, we divide the winding into six groups containing alternately 8 and 6 conductors per group.

Fig. 121 shows the connections between groups and Fig. 122 shows the complete connection diagram. The arrows in Fig. 122 correspond to those in Fig. 121 and indicate the polarity at a certain instant.

(To be continued.)

Electric Signaling with Bare Wires.

The British Home Office has issued a further report by R. V. Wheeler and W. M. Thornton on electric signaling with bare wires so far as regards the danger of ignition of inflammable gaseous mixtures by the break-flash at the signal wires. The earlier report dealt with battery bell signaling stations; the object of the later report is to define the precautions necessary in order that the bare-wire signaling system shall be rendered safe. Given certain restrictions as to battery power, there are several ways in which safe and efficient bells and relays can be constructed. The authors after describing these sum up their conclusions as follows:

(1). They are satisfied that the bare-wire system of electric signaling as commonly employed can be rendered quite secure from any danger of the ignition of inflammable gases at the break-flash at the signal wires or at the contracts of the signaling instruments.

(2). In order to promote safety, it is necessary in the first place to limit the battery power that is to be employed on any one circuit and in the second place to insure that the signaling instrument, whether bell or relay, shall comply with certain requirements.

(3). The present statutory voltage (25) sets a reasonable limit to the battery power, provided that wet Leclanché cells be used. Systems in which the battery used consists of dry primary cells, or secondary cells, or in which direct-current or alternating-current generators are employed can be rendered safe if, in addition to the use of anti-sparking devices embodied in the signaling instrument, sufficient noninductive resistance were permanently included in the bell circuit.

(4). The signaling instrument, bells or relays should have flame-tight covers and must be so constructed that when included in a circuit with a battery at 25 volts the break-flash produced when bare signal wires are separated after giving a signal is incapable of igniting an eight-percent methane-air mixture. There is no difficulty in constructing either the bells or relays to conform with these requirements.

Among the Contractors.

Hoffman & Elias, Jersey City, N. J., have submitted a low bid at $19,900 for electrical work in the new city hospital.

The Northwestern Electrical Company, of Grand Forks, N. D., has been awarded the contract for the installation of a power plant at Erskine, Minn.

The Home Electric Company, Escanaba, Mich., is making plans for the establishment of a branch in Detroit, Mich.

E. P. Baker, 75 North Main Street, Pawtucket, R. I., has been awarded the contract for installing electric-lighting systems in four school buildings in Pawtucket.

F. O. Peterson, electrical contractor, Duluth, Minn., has filed a petition in bankruptcy for the benefit of his creditors.

The Martien Electric Company, Cleveland, O., has the contract for the electrical equipment for a four-story addition, 50 by 108 feet, being erected by the James R. Gloyd Company, of Cleveland, for the Glidden Varnish Company in that city.

M. R. Johnson, formerly of the Johnson-Krabbe Electric Company, of Champaign, Ill., has sold his interest in that company. He has now started in business at 345 Hickory Street, Champaign, where he is conducting a general electrical contracting, repairing and battery-charging business under the firm name of Johnson Electric Company. He also contemplates carrying a line of electrical supplies.

The Coghlin Electric Company, Worcester, Mass., recently installed lighting fixtures in a high-class men's furnishing store in that city, which is regarded as nearly as perfect a system of illumination as is procurable. The installation consists of about 30 14-inch luminous-bowl fixtures, each containing a 300-watt nitrogen-filled lamp, suspended on chains from the white ceiling; and several smaller bowls of the same type under and over a gallery which extends around the store on three sides. The illumination aimed to be secured is eight to 10 foot-candles at the top of counters. The Coglin Electric has in prospect a number of other installations with the same type of units.

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"LET THE CODE DECIDE."

Secretary's Message.

The first section to report plans for the winter is the Western New England, which according to Mr. Day, acting chairman of the Executive Committee, will meet in Hartford, Conn., on October 10 when it is expected that Dana Pierce, of the Underwriters' Laboratories, will be present and numerous matters of interest will be considered.

The Secretary would be particularly interested to receive from our members reports of their experience in the field with switches or cutouts containing brass or copper-plated steel or iron parts. He would also suggest that the several sections would find the same subject an interesting one for a section meeting.

The August number of "Electrical Data," which recently came to hand from the Underwriters' Laboratories, contains much interesting matter, one of which refers to the subject of "Bushings in Conduit-Box Covers." The question was brought up by the Rule 32*h* in the Code. The whole section is too long to be quoted here, but the central point is contained in the following quotation, "There are numerous types of insulating bushings of porcelain and some other materials, which are not open to these objections and which are acceptable for this use. In addition to these, manufacturers have raised the question whether a metal bushing firmly spun into the hole in the outlet-box cover or formed in the metal of the cover itself does not serve every purpose for this service, and after considerable investigation and discussion it has been decided that such questions may be answered in the affirmative. A number of manufacturers have, therefore, produced lines of conduit-box covers with such metal bushings and the Laboratories are listing these as standard bushings under Rule 32*h* of the National Electrical Code, as well as those of the separable type."

There is also a quotation from a report of the Committee on Electricity of the New York Board of Fire Underwriters considering a list of 154 fires attributable to electricity during the year, which are traced to 19 different causes; of these 23 were due to short-circuits in flexible and similar cords, 27 to overheated flatirons and 15 short-circuits in motor fields or armatures. The loss due to these causes was in order $26,076.40, $21,822.94, $792, a total of $48,691.34 out of $68,993.08 due to the whole number of 154 fires. It was further shown that $40,433.43 was due to equipment installed or added to old without notice to any inspection department, leaving in the city only $28,559.65 due to inspected installations.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

In the Secretary's opinion the main point of interest in the above lies in the constant efforts being made by utilities, societies, and others interested in the sale of appliances or electrical energy to promote sales and increase net income through the increased use of all sorts of domestic appliances, which is certainly proper and natural in itself, but which is one of our greatest difficulties as inspectors and as the above figures indicate one of the biggest causes of fire loss, and frequently I believe a cause of hesitancy to use electrical energy later on when *no suggestion, hint or warning or any reference whatever* is made to the importance and necessity of seeing that these appliances are properly installed, on *suitable circuits* and above all reported to the proper inspection department for approval.

This again might well be made a subject of a paper and discussion at a section meeting of each section, and I believe should be taken up at an early date by a committee of the Association, composed of some of our very best men.

Side-Wall Protection.

Question 333. Is it permissible to use iron pipe for side-wall protection, if the wires have slow-burning insulation and are separately incased in flexible tubing?

Answer 1 (E). Yes, providing the flexible tubing extends in one continuous piece from support to support.

Answer 2 (P)*. This is a case for the exercise of discretion. Rule 26*N* second paragraph, definitely authorizes the placing of wire with slow-burning insulation in conduit under certain conditions. If the case involves dry location and excessive temperature, then permission should be readily given; if, on the other hand, the request arises from the desire to avoid two extra splices, as in changing from slow-burning to rubber-covered and back again, the matter is one for the department chief to settle.

Answer 3 (H)*. Slow-burning insulation, if it is protected by a flexible tube, can be used in this case by permission.

Answer 4 (B)*. Providing the iron pipe is merely for side-wall protection and is not conduit construction, wires with slow-burning insulation and each conductor separately incased in flexible tubing may properly be used in said pipe.

Answer 5 (F)*. Yes, Rule 26*e* explains construction of this kind, and it will be noticed that Rule 26 begins with "general rules," which includes wires with this insulation, of course.

Answer 6 (O). Rule 26*e*, third paragraph, clearly permits iron pipe for the use described. I feel, however, that the paragraph might be rearranged to express the point more clearly, my idea of it being as follows: Where slow-burning wires are to be protected on side walls from mechanical injury by iron pipe or conduit, the insulation of each wire must be reinforced by approval flexible tubing etc. If rubber-covered wires are used in approved conduit and the ends of conduit are equipped with approved terminal fittings, the flexible tube need not be used.

Answer 7 (V). Yes, if the tubing extends in a continuous piece on each wire from the insulator next below the pipe to the one next above.

Answer 8 (K)*. Yes.

Answer 9 (N)*. Certainly, by Rule 26*e*, third paragraph.

Switchboard Equipment.

Question 334. Does the National Electrical Code require that switchboards be equipped with a ground detector, voltmeter and pilot lights?

Answer 1 (E). We do not understand that the rule governing the installation and construction of switchboards does require the installation of these appliances. The intended use of the board would without doubt suggest what equipment would be installed thereon.

Answer 2 (P)*. The Code requires a ground detector as per Rule 7*a*. The other instruments are not definitely required, but Rule 2*e* conveys the intimation that they will probably be used. It would seem unreasonable to require a voltmeter for a very small machine and, on the other hand, just as unreasonable to require pilot lights for a 15,000-kilowatt machine under constant supervision.

Answer 3 (H)*. I do not find any definite requirement for ground detector, etc., in the Code, but Rule 2*e* would seem to indicate that such construction is necessary. It certainly is desirable from many points of view, even if the Code does not absolutely require it.

Answer 4 (B)*. While Rule 3 of the Code referring to switchboards does not specifically refer to ground detectors, Rule 2 relating to conductors and Rule 7 relating to insulation testing both do so.

Answer 5 (O). The Code does not require a voltmeter and pilot lights on a switchboard, but does require a ground detector on circuits not permanently grounded (Rule 7*a*).

Answer 6 (V). They are not required by the National Electrical Code, but are very often necessary.

Answer 7 (S)*. Rule 2*e* gives us information as to how these instruments should be installed. The Code does not require them in Class A installations, but Rule 94*c* (Class F) does, except pilot lights.

Answer 8 (K)*. Generator switchboards should be thus equipped, but I find nothing compulsory except in marine work.

Answer 9 (N)*. Ground detectors are required in marine work and on land circuits not permanently grounded as per Rule 15. Voltmeters are required on marine boards, hinted at elsewhere, as in Rule 2, but really necessary for decent running. Pilot lights are hinted at also, but really nonsense for anything except the smallest generators.

Home Economics Feature of New York Electrical Exposition—Calorimeter Tests To Be Made.

"It is manual labor that sends women to the scrap heap; women would do well to devote their energies to modernizing the home. Failing to adopt modern housekeeping aids, she works herself into a physical wreck," said Arthur Williams, general commercial manager of the New York Edison Company. Mr. Williams believes that an eight-hour day is more essential in the home than in the factory and he has undertaken to show how this may be accomplished at the New York Electrical Exposition, of which he is president, and which will be held at Grand Central Palace in New York City from October 11 to 21.

A comprehensive exhibit of the Bureau of Home Economics of the New York Edison Company is planned to show in a practical and scientific manner how the woman of today many conserve her time, health and energy by using modern electrical household devices. Every electrical invention for use in the home will be assembled for inspection and for trial. In conjunction with this exhibit there will be a laboratory where both technical and practical tests will be made of laundry, kitchen, pantry, dining room and general household devices and equipment by people especially trained in this work. There will also be a large living room where the smaller devices may be seen at any hour of the day or evening during the Exposition in actual operation. Tea will be served here every afternoon.

One of the most interesting features of the exhibit will be a series of scientific tests made by Dr. Langworthy's calorimeter which will show the vast contrast between the expenditure of energy in using the old-fashioned household devices and the modern electrical labor-saving equipment. The broom will be contrasted with the vacuum cleaner, the electric iron and the one heated on the stove, the old-fashioned wash tub and hand wringer with the modern electrical washing machine and wringer, the electric dish washer with the old dish pan in the sink. The plans also include a large government canning plant, electrically equipped and in full operation, where the modern methods of canning, approved by the government experts, can be seen.

War Effects on a London Lighting System.

English electricity undertakings which are almost entirely dependent upon lighting and domestic loads, have in some cases felt the war influences in a very marked manner. A case in point is the Hampstead municipal system, a good class residential borough, in London, with few industries calling for power. The net surplus of $13,835 shown last year becomes, in the latest accounts, a deficit of $33,550, which to any management would be disappointing, but which in the case of a plant which has only had one deficit before and that in the year of its initiation, is particularly regretted. The decrease in lighting revenue alone has been $21,315, the reduced street lighting accounting for $9,515, and reduced interior lighting, either in compliance with war regulations or as a consequence of economical habits, being responsible for the rest. In addition, the total net expenditure grew by $36,355, the advance in coal prices raising the fuel bill from $55,530 to $82,730. Developments were hindered owing to the Government restriction on capital expenditure on mains and services for extensions.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 360.—METER TROUBLES FROM LIGHTNING.—We have been put to some expense and trouble on small two-wire direct-current meters through lightning striking our direct-current overhead lines and going into these meters. We would like to know whether there is any approved provision for taking care of lightning on such direct-current lines and what experience other central stations have had in this matter.—W. J. A., New Orleans, La.

No. 364.—PREDETERMINATION OF FLOOD-LIGHTING EQUIPMENT.—Is there any simple rule or formula for determining in advance what size and number of projectors to use for flood lighting a given area? To take a specific problem, it is desired to flood light a football field from the extreme top corners of an open grand stand, which is 160 feet long and 30 feet high, the corners to be used being 60 feet from the near edge of the field. In this case, what projector equipment can be reasonably determined as being the most economical without several trial installations?—C. A. C., Madison, Wis.

No. 365.—NOISE ON TELEPHONE SYSTEM.—A small private telephone plant with 75 telephones is used for a credit system for charge accounts in a large store. It is operated on a small 55-volt generator. Usually there is very aggravating noise on the lines, being at times so great that it sounds as if there were insects fluttering in the head receivers. What is the cause of this? Could it be overcome by installing a storage battery? If so, how many cells would be required and how should they be best charged from 110 volts direct current?—J. S. B., Chicago, Ill.

No. 366.—UNLOADERS FOR ELECTRICALLY DRIVEN AIR COMPRESSORS.—What types of unloaders are available for electrically driven air compressors to prevent severe load fluctuations?—S. E. M., Chicago, Ill.

Answers.

No. 355.—SPECIAL LIGHTING DISTRICTS.—In what states, if any, is it possible to form lighting districts for the special purpose of providing more liberal or more ornamental street lighting by special assessment of all the property owners along the streets so lighted? What procedure is followed in organizing such a district? How does the plan work out in districts already established?—S. G., Yonkers, N. Y.

In California it is possible under the statute known as Chapter 247 of 1913, to form lighting districts in municipalities for the special purpose of providing ornamental or other street lighting, by assessment of abutting or adjacent property owners. Outside of municipalities, lighting districts may be formed for similar purposes under an act approved March 20, 1909, and amended by Chapter 259 of 1913. These acts are much the same in the results achieved, so that Chapter 247 only will be here commented on. This act provides in Section 1:

"Whenever the public interest or convenience may require, the city council of any municipality in the state shall have full power and authority to order * * * poles, posts, wires, pipes, conduits, lamps and other necessary works and appliances for lighting purposes, or any of said improvements, or any works, utility or appliances necessary or convenient for providing any other public service to be installed, constructed or maintained in and along any one or more of the public streets, alleys or other places in such municipality. * * * Also to order electric current, gas or other illuminating agent to be furnished for such power or lighting service in the manner and under the proceedings hereinafter described.

"Section 2. Before any improvement to be made * * * the city council shall adopt a resolution declaring its intention to do so, briefly describing the proposed improvement, and specifying the exterior boundaries of the district to be benefitted by said improvement, and to be assessed to pay the cost and assessment therefor, and to be known as the 'assessment district.' * * *."

Then follows in detail the procedure necessary for the installation of a lighting system. Under this procedure, as it has worked out in our city, the city collects the money for the installation and first two years' maintenance, and contracts for such installation and maintenance. After the first two years, maintenance contracts are made yearly, but in all cases the city collects the money in advance. Since money due for these purposes constitutes a lien on the property and if payment is defaulted property may be sold by the city, the non-payment difficulties under other systems are entirely obviated. Ordinarily the property owners stand all the installation expense, but the city pays one-fifth of the operating expense out of the general street-lighting fund, since the city saves one standard street light per block by reason of the presence of the ornamental system.

In suburban districts where the lighting system provided is the only one in the district there is but a single fund from which all expenses are paid.

As a matter of interest, there is presented herewith in some detail a schedule outlining the procedure followed in municipalities under Chapter 247:

Schedule.—Proceedings may be started by a petition from property owners, or by direct order of the Common Council.

(1) Resolution declaring intention to order improvement, specifying and describing boundaries of assessment district and ordering certain percentage paid by the city (usually 20 per cent of maintenance expense).

(2) Council calls on city engineer for report which includes: (a) Plans and specifications for the work. (b) Estimate of costs and expenses. (c) Assessment diagram, showing dimension of each subdivision of land within assessment district and giving each subdivision a red-ink number. (d) Assessment roll, giving a proposed assessment to each subdivision and referring to same by red-ink numbers and giving names of owners, if known. Assessment is made according to the benefits to be received by such subdivisions. Mistake in name of owner does not invalidate assessment.

(3) Engineer's report filed with the city clerk.

(4) Council accepts engineer's report (may modify same) and appoints a time and place to hear protests against improvement.

(5) City clerk advertises resolution of intention and date of protest in daily or weekly paper (two successive insertions) and also posts notices on all streets in assessment district.

(6) Protest sustained or denied. Protests must be in writing and be filed with the city clerk. Majority of property front feet must be represented by protestants affected to stop proceedings.

(7) Council confirms engineer's report and assessment and passes resolution ordering work.

(8) Assessment diagram and roll delivered to tax collector, who fixes date not less than 30 days from receipt of diagram when assessments become delinquent, also a date not more than 60 days or less than 50 days from receipt of diagram for the sale of parcels of land for unpaid assessments. Delinquencies must be published.

(9) Funds collected held by city treasurer and designated by name of said improvement.

(10) Bids for improvement received by Council. Bids may be received and contracts awarded at any time after any portion of money is collected.

(11) Contract awarded.

In case assessment is not sufficient to cover work, additional assessment is made. If assessment realizes a larger sum than is needed, refund is made pro rata.—L. M. K., San Diego, Cal.

No. 358.—REACTANCE COIL.—I desire to construct a reactance coil to operate in series with a resistance of 10 ohms on a

220-volt, 60-cycle circuit. I want to vary the current in the circuit from 10 amperes to about 22 amperes by adjusting the iron core in the reactance coil. I have an iron core four inches square by 12 inches long made of 0.014-inch sheet iron. Should like to know what size and how many turns of wire to place on this core to get the required voltage drop when 10 amperes is flowing through the circuit, also formulas and methods used in calculating the number of turns of wire.—L. H. W., Cincinnati, O.

Because it is not possible to build a reactance coil which will have no resistance, you can not get 22 amperes with such a combination unless you short-circuit the reactance coil for the maximum current. The following are data for a reactance coil to suit your requirements.

Let L=self-induction of the coil

$=V/2\pi ni$

where n=frequency of supply,

i=root-mean-square value of the current,

and V=effective reactance voltage=110 volts nearly.

Then L=0.0292 nearly.

Now let N=number of turns on the coil,

and ϕ=total flux generated in core;

then $N\phi=10^8\sqrt{2}Li=42{,}000{,}000$ nearly.

The cross-sectional area of the core is 104 square centimeters.

In a straight open core it is difficult to figure closely the magnetic reluctance. From a curve at hand I deduced the following

N=290 turns

ϕ=144,700=total flux

$B=\phi/104$=1,385 lines of force per square centimeter.

After allowing for insulation on the core, the mean length of one turn is about 20 inches. This gives a total length of 485 feet. No. 6 or 7 B. & S. gauge double-cotton-covered copper wire should be used and will weigh about 38.5 pounds.

When the core is all the way out the flux of the coil will be

$$\phi=1.25iN\times 104/l=27{,}400$$

where l=length of coil in centimeters.

The reactance$=\sqrt{2\pi nl\phi 10^{-8}/i}=1$ ohm nearly.

The impedance$=\sqrt{1^2+(0.136)^2}=1.136$ ohms, if No. 6 B. & S. wire is used.

Thus the maximum current will equal 19.8 amperes.

The impedance of the coil with the core all the way in should be about 11 ohms, and as a check

the reactance$=\sqrt{2\pi nl\phi 10^{-8}/i}=11.576$ ohms,

and the impedance$=\sqrt{11.576^2+0.136^2}=11.59$ ohms.

—J. H. McI., Sharon, Pa.

No. 361.—Current Rating of Motor Conductors.—The ampere rating of a direct-current, six-pole, 230-volt motor is 226 amperes. The brushes span three full commutator bars. The copper strap in the coils comes to the bar as a single conductor 3/64 by ⅞ inch. The ampere rating of another direct-current, six-pole motor is 227. The brushes span 2¾ bars. The armature conductor is a copper strap ⅛ by ⅞ inch. The ampere rating of a four-pole direct-current motor is 153 and its brushes span 1⅔ bars. The copper in each coil of the armature is 41,636 circular mils in area. I would like to have the opinion of experienced motor designers as to which of these motors is best proportioned as to current capacity of conductors, that is, circular mils per ampere, and what actual value is best practice for this purpose.—R. D., Washington, D. C.

The question whether an electric motor is well designed cannot be answered satisfactorily from the meager data given in the question. The current density in the armature conductors depends on the speed, ampere-wires per unit circumference, magnetic density in the iron and ventilation. In normal motors as they are manufactured in large quantities for stock, the current density per conductor ranges usually from about 3,200 amperes per square inch in very small motors to about 2,600 amperes per square inch in motors of 75 to 100 horsepower. The width of the brush has nothing to do with this.

Of the three motors mentioned above, the first has, with a series winding, a current density of $113\times 512/21=2{,}760$ amperes per square inch. This is good practice. In the second motor this figure, for a series winding, would be $113.5\times 64/7=1{,}240$ amperes per square inch, which is decidedly very low even for a motor with a very low speed. In the third motor the section of the conductor is 0.0345 square inch, which gives, again for a series winding, $76.5/0.0345=2{,}220$ amperes per square inch. Also this seems low.—H. A., Pittsburgh, Pa.

No. 362.—Drive for Ventilating Fan.—Is a chain drive considered as good or better than a belt for a motor driving a ventilating fan? We have a three-phase motor and find that there is a very great strain on the motor at starting. How can this be overcome?—H. D., Detroit, Mich.

Belt drive is better than chain drive for such service, because at starting there is considerable strain; the belt can be adjusted so that it will slip a little at starting, which relieves the motor a little; as the fan accelerates, the slippage decreases until the fan is running at full speed. With chain drive there can be no slippage, and consequently the motor has to bear the full strain.

Motors for such service should be specially designed with high torque at starting with comparatively low current. In the larger sizes they should be of the slip-ring or wound-rotor type, because the starting load of such large fans is abnormal and the motor must be designed to meet this abnormal condition. An ordinary three-phase squirrel-cage motor will hardly give good service under such conditions, unless the fan is rather small and the speed low, in which cases the fan is usually direct-connected. The best thing to do is test the motor under load and plot the load curve. It can then be seen what the conditions are, both at starting and running loads. The chances are that the motor in question has not the necessary special characteristics.—W. T. E., Ansonia, Conn.

No. 363.—Storage-Battery Auxiliary for Small Central Station.—I would appreciate information relative to the advantages arising from the use of storage batteries in connection with dynamos in a small central station. Also what actual saving is effected by this practice? The station in question gives 110-volt day and night service to a small town and at peak delivers about 230 kilowatts. The load is about 200 amperes between midnight and 5 a. m., then rising to about 1,000 amperes at 9 a. m., at which it varies but little until 2:30 p. m., when it rises steadily to a peak load of 2,100 amperes at 5:30 p. m. At 6:30 p. m., it begins to fall gradually until at 9:30 p. m. the demand is about 1,200 amperes, declining very quickly from then on to midnight when it is about 200 amperes.—W. B., Wilkinsburg, Pa.

The use of the storage battery in a small central station makes it possible to operate the generating units at their full-load ratings, thereby resulting in better efficiencies. According to one method the generating units can be operated, say from 9 a. m. to 10 p. m. at the plant in question, delivering the load and at the same time charging the battery, running all the while at nearly maximum load with consequent maximum efficiency, thereby decreasing the cost per kilowatt-hour. Then, during the remainder of the 24 hours the entire load may be carried by the battery, resulting in the saving of considerable labor cost during this period.

It has frequently been found that the increased efficiency of the engines and generators, caused by the additional load while charging the battery, results in scarcely any appreciable increase in the fuel bill during this period, while during the discharge period when the generating units are shut down, the fuel bill drops off almost entirely.

According to another method, generating apparatus with smaller capacity than is demanded by the peak load may be employed, thereby saving on installation cost, especially where the peak is of short duration because then the cost of the battery is offset by the cost of the generating installation which it replaces, leaving the improved economy as a clear gain. In this method the generating equipment is kept operating constantly, the battery being charged while the load is light. At the peak load the battery discharges, so adding its capacity to that of the generating equipment.

In addition to the above there is the advantage of the battery as a reservoir of energy, always ready for instant use in case of emergency.—R. W. R., Philadelphia, Pa.

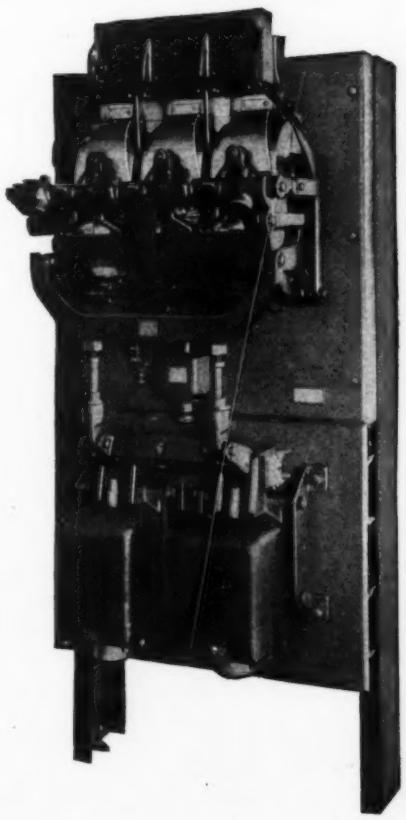
NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

A 20,000-Ampere Direct-Current Circuit-Breaker.

The 20,000-ampere direct-current, circuit-breaker illustrated herewith is the most recent solenoid-operated type of circuit-breaker developed by the General Electric Company for controlling direct-current circuits of unusually high capacity. The 20,000-ampere rating is the normal continuous rating.

This powerful circuit-breaker is one of four units of the same capacity built for the Aluminum Company of America for installation at Massena, N. Y. The closing and opening movements under normal conditions are controlled by a single-pole double-throw control switch mounted remote from the breaker on the switchboard or in any other convenient location. On overload or short-circuit the breaker opens automatically by means of the direct-acting trip. The breaker is mounted on a 2.5-inch slate panel. The solenoid is supported by a steel base.



Solenoid-Operated Direct-Current Circuit-Breaker with a Continuous Rating of 20,000 Amperes.

The use of solenoid-operated and other types of distant-controlled circuit-breakers simplifies station wiring, reduces length of main cables, and economizes space at the point from which operation is controlled, which accounts for the increasing application of these devices.

The Silver Voltameter.

For over ten years the Bureau of Standards, Washington, D. C., has been making a study of the silver voltameter, which is used in precision measurements of electric currents. A summary of the results of the experiments is given in Scientific Paper No. 285. A few of the principal results may be summarized as follows:

(1) The effect of filter paper on silver-nitrate solutions (whether the paper is used in the voltameter itself, as has been commonly done, or whether it is used in the preparation of the silver-nitrate solution) was shown to be serious and to result in the formation of colloidal silver. This effect of the filter paper is due to the formation of reducing agents from the oxycellulose of the paper itself and is not due to impurities.

(2) The appearance of the deposit is altered by the presence of impurities in the solutions (such as those resulting from filter paper). Pure solutions give crystalline deposits of very pure silver, but colloids, if present, break up the crystals and produce striated deposits which are too heavy to represent accurately the amount of electricity which passed through the voltameter.

(3) Many forms of voltameter have been compared. The Bureau has found that the most satisfactory are the porous-cup voltameter and the new form devised by F. E. Smith, of the National Physical Laboratory, England.

(4) The Bureau has devised means for preparing pure silver nitrate and suitable tests for it, so that an electrolyte of a uniformly high state of purity can be prepared. These tests are for acidity and for reducing agents. The Bureau has also found that the agreement between the results obtained from large and from small sizes of voltameters, used simultaneously, is a valuable test of purity; impure solutions (except for acid) invariably give heavier deposits in the large-size voltameters.

(5) The temperature coefficient of the voltameter is found to be zero.

(6) Tests of the purity of the silver deposits show that when made from pure electrolyte, the impurities included with the silver crystals represent on the average only 0.004 per cent of the weight of the deposit.

(7) The absolute electrochemical equivalent of silver was found to be 1.11800 milligrams per coulomb and the voltage of the Weston normal cell was found to be 1.01827 volts at 20 degrees Centigrade.

(8) Comparisons with the iodine voltameter were made and the ratio, the amount of silver deposited to the amount of iodine deposited by the same current, was found to be 0.85017, which, corrected for the inclusions in the silver deposits, gives 0.85013. The electrochemical equivalent of iodine in absolute measure was computed to be 1.31507 milligrams per coulomb.

The value for the faraday on the basis of the absolute electrochemical equivalent of silver and of iodine and the atomic weights is as follows:

On the silver basis (Ag = 107.88)	96,494
On the iodine basis (I = 126.92)	96,512
Mean	96,503

The best round value which can be assigned to this constant appears to be 96,500 coulombs.

Efficient and Compact Dry Battery.

After a great deal of experimental work a new form of dry battery has been invented by H. R. Palmer, of Cleveland, O. This battery possesses several distinctive features. It is put up in rectangular form, the outer container being of such depth as to include from 2 to 8 individual cells. These cells are permanently connected in series so that the combined battery has only two terminals, which are

Five-Cell or 7.5-Volt Dry Battery.

clearly marked negative and positive. These batteries thus have voltages ranging, in steps of 1.5 volts, from 3 to 12 volts. The face of the battery in each case measures 4.5 inches wide by 6.5 inches high and has a thickness or depth ranging from 2.625 to 8.625, depending on the number of cells included.

Each individual cell, instead of being of the ordinary round form, is flat and has its elements so arranged as to be not only very compactly assembled but so that they are used to the best advantage. The electrodes have an exceptionally large depolarizing area which serves to give better voltage regulation on closed circuit and also much more rapid recovery on open circuit. The zinc electrode as well as the depolarizer and electrolyte are completely consumed at the end of the battery's useful life. This life is said to be exceptionally high. The cells have a very low internal resistance. On account of the way in which the battery is mounted, it is practically impossible to injure it by moisture, weather, etc. These batteries have been repeatedly submerged under water without any appreciable deterioration.

A distinctive feature of these batteries is that the zinc electrode does not form part of the containing vessel and can therefore be used completely without destroying the cell itself. The zinc is in the form of corrugated sheets in intimate contact with the electrolyte and depolarizer "mix" which are in thin layers and contain about five per cent more moisture than the ordinary round dry cell. On account of this improved internal construction and its resultant higher efficiency, the life of the new battery is said to be more than twice that of an ordinary dry battery and to give 50 per cent more heat in the spark when used for automobile ignition purposes. The batteries, although arrangd with series grouping of the individual cells unless otherwise ordered, may also be obtained with various series-parallel groupings where exceptionally heavy current demands have to be met. In all cases, however, only two terminals are provided for the complete battery. The batteries are always put up in a stout metal outer container, making a very sturdy combination.

These batteries can be used for any purpose requiring dry cells. They have been particularly satisfactory for such uses as require a battery of high current capacity and maintained voltage. On account of their high capacity they have been given the trade name "Hywatt" electric batteries. They are being manufactured and marketed by the Cleveland Battery & Electric Company, 1974 East 66th street, Cleveland, O.

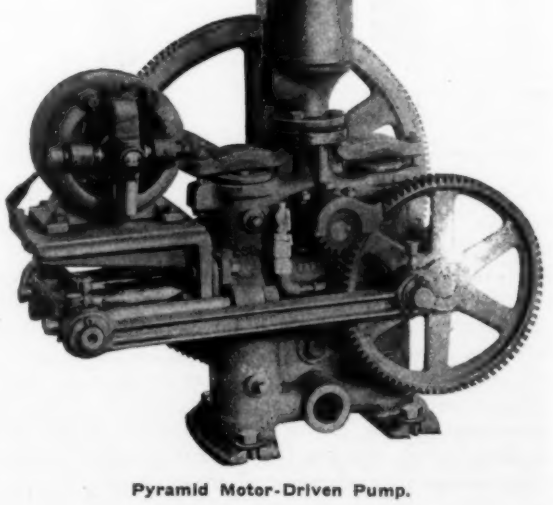
Pyramid Motor-Driven Double-Acting Piston Pump.

The rapid extension of electric power circuits throughout towns, villages, and country districts has now made it possible and desirable to have a power pumping equipment for general water supply, fire protection and various other services on farms, and country estates. That the reliability and convenience of power pumping is appreciated is evidenced by the large sales such pumps are enjoying. To meet the demands for a reliable, rugged, and compact power pump, the Goulds Manufacturing Company, Seneca Falls, N. Y., has developed a line of single-cylinder double-acting piston pumps of which the one illustrated is typical.

The pump shown is the 2.5-by-4-inch size of the well known Pyramid line, and has a capacity of six gallons per minute against elevations up to 100 feet. It is operated by a quarter-horsepower Westinghouse motor mounted on a bracket attached to the pump, thus making a very compact outfit.

The Pyramid pump is said to contain features not found in any other small-capacity pump made; it has large and easy waterways and few parts. The base cylinders, bearings, and one cylinder head are cast in one. Casting the bearings as a part of the cylinder keeps the gearing absolutely in line and greatly decreases wear, with a corresponding increase in the life of the pump. The cylinder is brass-lined and is provided with large suction valves just below the bore of the cylinder. These valves are easily accessible through two handholes, the covers of which can be removed by backing off one bolt. The discharge valves are above the cylinder and reached through handholes located at either side of the air chamber.

The outfit illustrated is especially adapted for elevated-tank water-supplying systems. It can be used for pneumatic-tank water-supply systems by employing a separate air pump. Fitted with special valves and gaskets, it can be used for pumping gasoline, for which service it has been approved by the National Board of Fire Underwriters.



Pyramid Motor-Driven Pump.

Electric Purification of Water in Swimming Pool.

The leading summer resort of St. Louis, Mo., was the first to install in its 400,000-gallon outdoor swimming pool, a water-sterilizing system approved by the government public health authorities.

To keep this large body of water fresh and free from germs and other impurities, the park management has installed an ultra-violet-ray sterilizer. The water entering the pool is passed through a battery of filters and then conveyed to the top of a beautiful cascade, where the sterilizer is located and in plain view (note arrow in photograph). There it is exposed to the destructive ultra-violet rays, which eliminate any germ life while passing through them, and a volume of pure, clean water is delivered, adding life and sparkle by the areation received in its passage over the falls.

The body of water in the pool is kept in circulation, being constantly drawn off at the deepest point to make room for the fresh supply. By this means one is not subjected

Electric Sterilizing and Aerating Equipment in St. Louis Swimming Pool.

to bathing in still water, but in a refreshing, live water equal to the mountain streams. Swimmers comparing this pool with others readily observe the difference between the usual "flat" pool water and the water in this pool, besides knowing that they are thoroughly safeguarded against the dangers lurking in the waters of the ordinary pool. Water sterilized by the ultra-violet-ray system is said to be really superior to water in any running stream; in fact, it is claimed that few persons have as pure water in their private baths.

The ultra-violet rays are produced by a mercury-vapor arc, which is inclosed in a quartz tube. These rays have for many years been known for their germicidal action. Several of the European nations at war have special field equipment for sterilizing drinking and cooking water for their soldiers by means of ultra-violet rays.

The equipment in use in St. Louis is manufactured and installed by the Electric Sterilization Company, 1201 Central National Bank Building, St. Louis, Mo.

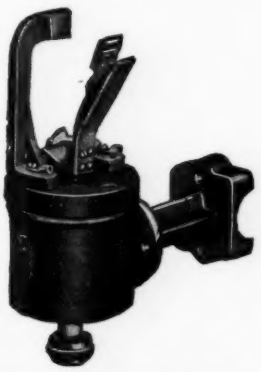
Rechargeable Dry Cell.

A new type of dry cell with unique features has been put on the market. Its construction aims to overcome the principal disadvantages of the ordinary dry cell, namely, the tendency to dry up and therefore lose strength if kept in stock for a long time before purchase, and the impossibility of effectively recharging the cell when it is exhausted. Other advantages are also claimed for the new cell.

The most striking feature that permits attaining these characteristics is that the elements of the cell can be replaced when run down without discarding the containing case and cover. This case is made of zinc, covered with an insulating coating; the cover is made of a special waterproof cork composition. The recharge elements—carbon, zinc, salammoniac, all complete—can be easily inserted in the jar, water added and the cell is complete and ready for use again. When the original cells and the recharge elements are sold, they are quite dry and require merely the addition of water to make the contained electrolyte serviceable. This avoids deterioration while kept in stock. This freshness of the cell elements, combined with the efficient arrangement thereof, is said to account for them lasting two to five times longer than an ordinary dry cell. This is claimed to make use of this cell with renewals more economical than use of the corresponding No. 6 common dry cell. The new cells are also claimed to withstand temperature and other climatic changes very well.

This new cell is known as the Burn-Boston recharge semi-dry cell. It is manufactured by the Burn-Boston Battery & Manufacturing Works, 134 State Street, Boston, Mass.

Rechargeable Dry Cell.



Solenoid-Control Relay for Circuit-Breakers.

A New Solenoid-Control Relay.

Solenoids for operating large carbon-break or oil-break circuit-breakers frequently require comparatively large currents in the closing solenoid. In such cases, the contacts of the solenoid-control switch, which controls the operation of the solenoid, are not suited to operate the closing solenoid and it is necessary to use also a control relay with its operating coil excited by the closing contacts of the control switch and the relay contacts in series with the closing solenoid.

A recently developed control relay is in use for this purpose. The relay consists essentially of a solenoid, plunger and contacts. There is a metallic connection, consisting of a small flexible lead, between the movable contact arm and its support. The contacts are kept clean by a wiping motion each time the relay is operated. The relay can be closed by hand by an insulated button on the lower end of the relay plunger. This relay is made by the General Electric Company, Schenectady, N. Y.

INDUSTRY ACTIVITIES

Nehring Electrical Works, Dekalb, Ill., expects to have its factory for the manufacture of insulated wire and cable ready for operation about October 1.

Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., is sending out a mailing folder descriptive of Reco electric flags, flashers and color hoods for incandescent globes.

General Radio Company, Cambridge, Mass., has issued additional catalog sheets, on variable air condensers, audibility meters, phantom resistances, standard condensers, standards of resistance and decade resistance boxes.

Wagner Electric Manufacturing Company, St. Louis, Mo., announces the opening of a sales office and service station at 922 North Pennsylvania Street, Indianapolis, Ind. The office will be in charge of Charles M. Welch.

Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, has issued bulletin No. 48,707, on direct-current motors and controllers for job presses, folders and bookbinding machinery.

Auth Electrical Specialty Company, 25 Howard Street, New York City, has prepared catalog sheets on its lines of separable connectors, fused battery strips, low-tension apparatus, push buttons, annunciators, signal systems, etc.

Central Scientific Company, 460 East Ohio Street, Chicago, Ill., has issued a booklet on De Khotnisky electrically heated and regulated constant-temperature heating appliances, which include drying ovens, incubators, bomb furnaces, etc.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued bulletin No. 1,810, on all-steel jaw crushers and automatic electric hoists for rock-crushing plants, and booklet No. 1,637, on horizontal cross-compound pumping engines, the latter a 78-page booklet giving a detailed description and performances of this machinery together with illustrations of a number of installations.

Triumph Lamp Works, 147 Palisade Avenue, Union Hill, N. J., has issued, under date of September 1, its price list of guaranteed nitrogen and argon gas-filled lamps. The 40 and 60-watt lamps are guaranteed to have a life of 500 hours under proper conditions; the 100 to 250-watt lamps 700 hours, and the 300 to 1,000-watt lamps 1,000 hours. Lamps burning less than the guaranteed number of hours are replaced on the basis of the hours they burn.

The Electric Storage Battery Company, Philadelphia, Pa., is sending out a letter to central-station companies regarding the sale of energy for charging commercial and pleasure electric vehicles and industrial electric trucks. The letter states: "The four types of Exide batteries are used very largely and very successfully in this service. The Ironclad-Exide is the most popular type. It has demonstrated its rugged qualities, its economy in upkeep and greater freedom from care, its tremendous power in hill climbing and in starting heavy loads on grades. The best recommendation that can be given is that the oldest users of this battery are the largest. It can be recharged at high rates, is a service battery for winter and summer and reduces the cost of battery operation to a minimum. When the matter of pushing the use of electrics is brought to attention it should be borne in mind that the four Exide batteries—Exide, Hycap-Exide, Thin-Exide and Ironclad-Exide—have helped as much as any other one feature to make the electric vehicle and the industrial truck the success that they are today."

Pass & Seymour, Incorporated, Solvay, N. Y., have issued, under date of September 7, a revised list price sheet on weatherproof aluminum-shell sockets.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog 3-B, on switchboard, portable and precision instruments, ammeter shunts, instrument transformers, and relays.

American Electrical Works, Phillipsdale, R. I., has issued, effective September 8, a price list on its lines of bare and weatherproof copper wire and cable, galvanized iron wire, magnet wire, rubber-covered wire, lamp cord, etc.

The Mechanical Rubber Company, Cleveland, O., has issued the September number of the *Marco Press,* which contains several articles on the applications of the company's rubber belting and a list of belting carried in stock. The company's 33 branch houses are also listed.

Appleton Electric Company, 218 North Jefferson Street, Chicago, Ill., has advised that 1,400 of its type No. 2 rectangular steel Unilets for one-half-inch conduit, together with receptacles and numerous other fittings, were used in the outline lighting of the new office building of the Arkansas Valley Railway, Light & Power Company, Pueblo, Colo., which was described in the September 16 issue of this publication.

Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., in a recent issue of its bulletin to salesmen points out the advantage of working for a company that handles a line of general supplies together with a line of specialties. The company has a general line that is not duplicated for variety, stock and buying power by any other jobber and has a specialty business line that is very comprehensive. Its Okonite wire agency would make a complete business in itself and the same is true of its lines of Maxolites, Ralco plugs, D. & W. fuses, Columbia lamps, Alexalites and Berylites—many salesmen traveling the country with no greater lines. It is the company's lines of specialties that enables it to advertise to advantage, and through advertising the specialties, it also advertises its general line. This fact makes the Central Electric Company one of the few advertising jobbers in the country, because jobbers, as a rule, have nothing to advertise but their service and in most cases they do not wish to do that.

Hughes Electric Heating Company, 215 West Schiller Street, Chicago, Ill., is introducing an electric heater for warming automobile engines and radiators in unheated garages. With the rapidly increasing use of automobiles during the winter months, chilled engines and frozen radiators are the most serious problems of the private garage owner. To adequately heat the entire garage is quite expensive and unnecessary, as the vitals of the car under the hood are the only parts which need to be protected from the cold. To drain the radiator every time the car is brought in means refilling with warm water, and the engine is usually so cold that it requires considerable work and priming to start it. The problem has been solved by an electric engine and radiator warmer which is simply screwed into any lamp socket in the garage and placed down in the hood of the car between the engine and the radiator. The body of the heater contains a rugged heating element which consumes one-tenth of a kilowatt and gives off enough heat to keep the radiator from freezing and the engine from causing starting trouble. This heating element is inclosed in a black enameled metal shell about the size of an ordinary dry cell. The outfit is well insulated, fireproof and safe in every respect, weighs less than a pound and comes equipped with 10 feet of cord.

PERSONAL AND BIOGRAPHICAL

MR. RAY PALMER, former vice-president and general manager of the New York and Queens Electric Light & Power Company, Long Island City, N. Y., was elected president of that company September 19, succeeding MR. C. G. M. THOMAS, who was elected chairman of the board of directors. Mr. Palmer was born in Sparta, Wis., in 1878 and was graduated from the University of Wisconsin in 1901. He become associated with J. G. White & Company, and in the position of assistant superintendent of construction for that company had charge of the installation of the street-lighting system in Greater New York City. Later he was transferred to the company's office in London, England, with the title of electrical engineer. On his return to America several years later he became

Ray Palmer.

electrical engineer for the Union Traction Company of Chicago. In 1906 he left the traction company and practiced as a consulting electrical engineer in Chicago and Milwaukee until 1912, when he received the appointment of commissioner of gas and electricity for Chicago. While Mr. Palmer held this position, a period of three years, he superintended the rehabilitation of the city's lighting system and replaced the old-style arc lamps with flame arcs and high-efficiency tungsten lamps. In August, 1915, he resigned to resume his engineering practice in Chicago, but in the fall became vice-president and general manager of the New York & Queens company. Mr. Palmer is a Fellow of the American Institute of Electrical Engineers, a member of the Western Society of Engineers, the Illuminating Engineering Society and the Engineers' Club of New York.

MR. S. B. IRELAND, formerly second vice-president and general manager of the Bartlesville (Okla.) Interurban Railway Company, has recently been appointed manager of the City Light & Traction Company, Sedalia, Mo. He succeeds MR. HARRY D. FRUEAUFF, who has been appointed general manager of the Montgomery (Ala.) Light & Water Power Company.

MR. MAX W. ZABEL has removed his offices to 1336 Monadnock Block, Chicago, Ill., where he will continue the practice of patent and trade mark law.

MR. FRANK W. FRUEAUFF, of Henry L. Doherty & Company, and vice-president of the Cities Service Company, was the recipient of many congratulatory messages September 15, the twenty-fifth anniversary of his entrance into the electrical and public utility field. After his graduation in June, 1891, from the East Denver (Colo.) High School, Mr. Frueauff placed an application for a position with the old Denver Electric Company. On September 15 he began his career as public utility operator, although at the time the position was termed lamp boy. The Denver Electric Company was later merged with the Denver Gas Company, which in turn became the present corporation—the Denver Gas & Electric Light Company, which is one of the leading companies in the Doherty organization.

DR. P. G. NUTTING, formerly physicist and director of the research laboratory of the Eastman Kodak Company, Rochester, N. Y., has been made director of the research laboratory of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Dr. Nutting, who was born in 1873, is a graduate of Carleton College, Leland Stanford University and the University of California. He also studied at the University of Gottingen and received the degree of Ph. D. from Cornell University in 1903. He was assistant physicist from 1903 to 1909 and associate physicist from 1909 to 1912 at the Bureau of Standards, and in 1913 became associated with the Eastman company. Dr. Nutting is a member of numerous scientific and engineering societies and has been particularly active in the Illuminating Engineering Society. He has written several noteworthy papers on illuminating engineering topics.

MR. AUSTIN KIMBLE, who since the organization of the Kimble Electric Company, of Chicago, has been actively engaged in the development of its motor business, has sold his interest in the company and associated himself with the Northwestern Electric Company, of Chicago, as manager of its newly established variable and adjustable-speed alternating-current motor department. While serving as a stationary engineer many years ago Mr. Kimble took up the study of electrical engineering, devoting himself particularly to one of its most difficult branches, that dealing with variable and adjustable-speed alternating-current motors. He became connected with the Frank S. Betz Company and brought out for it one of the first variable-speed alternating-current motors. Twelve years ago he organized the Kimble Electric Company, becoming its vice-president and secretary and devoting himself almost entirely to the development of Kimble variable and adjustable-speed alternating-current motors, large numbers of which are in sucessful use. Mr. Kimble is one of the best known inventors and engineers in this special line, a large number of patents having been granted to him. In his new association with the Northwestern Electric Company, he is devoting himself exclusively to the commercial development of a new line of variable and adjustable-speed single-phase motors, many of which have already been successfully applied.

MR. W. E. HASELTINE, general manager and one of the chief owners of the Ripon (Wis.) Light & Water Company, has accepted the position of superintendent of the Wisconsin Power, Heat & Light Company, of Milwaukee, which was organized last April, and which operates electric-lighting and heating plants in Omro, Beaver Dam, Portage, Bara-

W. E. Haseltine.

boo and a number of other Wisconsin cities. Energy is supplied from a hydro-electric plant at Kilbourn. Mr. Haseltine will retain a supervision over the Ripon Light & Power Company, and MR. W. E. EXNER, who has been assistant manager, will take charge. Mr. Haseltine is president of the Wisconsin Electrical Association.

MR. WALTER A. GATWARD has been appointed a research assistant in the Department of Electrical Engineerng of the University of Illinois. Mr. Gatward was graduated from Washington State College in 1913 and was employed in the operating and engineering department of the Washington Water Power Company, of Spokane, during 1913 and 1914. In the latter year he was appointed a research fellow in the Engineering Experiment Station of the University of Illinois, Department of Electrical Engineering. He received the degree of master of science from that university this year.

OBITUARY.

MR. ROBERT M. WEBB, of Fort Worth, Tex., died September 16 in Brooklyn, N. Y., aged 53 years. At one time he was manager of the Colorado Electric Light & Water Works and the Colorado Telephone Company.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company is preparing plans for the construction of a new power plant. French & Hubbard, 88 Pearl Street, Boston, Mass., are the engineers.

FARMINGTON, MASS.—The Public Utilities Commission is considering a petition of the Stanley Works of New Britain and the Farmington River Power Company, asking for permission to extend a high-tension transmission line from Farmington to New Britain.

LUNENBURG, MASS.—Plans are being considered by A. A. Cook, electric light commissioner, for the extension of the municipal electric-lighting system to Goodrichville, Mulpus and Flat Hill.

PITTSFIELD, MASS.—The Pittsfield Electric Company plans to extend its lines from the city limits to Lenoxdale, by the east side of the Housatonic River. It desires to supply the Smith Paper Company's mills with power.

NEW HAVEN, CONN.—The Connecticut Company is about to make extensions and additions to its power station on Grand Avenue, the new buildings and equipment to cost about $120,000. It is for the purpose of providing better power service to the company's street railway lines in the city and suburbs.

DUNKIRK, N. Y.—The Common Council has approved a restrictive franchise to the Niagara & Erie Power Company. The contract protects the municipal power plant in that the company has agreed to leave undisturbed all city customers, providing power to users of not less than 75 kilowatts. The company will sell power at 15 per cent less than is charged to consumers by the city, and will expend over $150,000 to extend its lines to Dunkirk. The franchise is for 40 years.

LE ROY, N. Y.—The Board of Water & Light Commissioners has entered into a contract with the Le Roy Hydraulic & Electric Light Company which provides for all-night operation of the lighting system, and for the installation of additional lighting equipment.

LYONS, N. Y.—The Salmon River Power Company, which owns the plant of the Niagara, Lockport and Ontario Power Company here, is enlarging the power plant to double its former capacity. The total capacity of the station when improvements and extensions have been made will be 25,000 horsepower.

MIDDLETOWN, N. Y.—The Common Council is considering plans for the installation of a new lighting system on North Street, the installation to be made by the Orange County Light Company.

OGDENSBURG, N. Y.—The Aluminum Company of America has completed negotiations for right of way between Pyrites and this city for a high-tension transmission line the company will erect to furnish electrical energy for power and lighting in Ogdensburg.

PORT HENRY, N. Y.—The Port Henry Light, Heat & Power Company has increased its capital stock from $50,000 to $100,000. Improvements to its plant are contemplated.

SCHENECTADY, N. Y.—The Public Service Commission has announced approval of the merger of the Schenectady Power Company and the Hoosac River Electric Light & Power Company. The latter company has been virtually owned by the former for several years.

WATERFORD, N. Y.—The Public Service Commission has granted the petition of the Troy Gas Company for the right to exercise an extension of its electric-lighting franchise here.

CEDAR GROVE, N. J.—The Public Service Electric Company is arranging for the installation of a street-lighting system on certain county roads. Permission for construction has been asked.

NEWARK, N. J.—The German Hospital will build a new concrete power house on Bank Street.

NEWARK, N. J.—The Board of Works has approved plans and authorized a call for bids for the erection of an electric light and power plant in connection with a proposed municipal garbage disposal station.

NEWARK, N. J.—The Public Service Corporation of New Jersey has inaugurated a new policy of financing extension and improvement work by sales of stock issues, instead of bond issues, as heretofore. A new issue of stock, totaling $5,000,000, has been authorized, the proceeds to be used for new construction work. This new issue will be sold to present stockholders at par value ($100) to the extent of 20 per cent of their present holdings. A quarterly dividend of 2 per cent has been declared, payable to stockholders of record September 25.

SOUTH RIVER, N. J.—The Borough Council is considering the installation of a new 300-horsepower gas engine in the municipal electric-lighting plant. R. F. Fountain is president of the Board of Public Works.

ALLENTOWN, PA.—The Lehigh Valley Light & Power Company, a subsidiary of the Lehigh Valley Transit Company, has announced a reduction in lighting rates from 11 to 10 cents per kilowatt-hour in Allentown, Catasauqua, and neighboring sections. The company will install a new turbogenerator at its Allentown power plant, increasing the capacity to 42,000 horsepower.

CHESTER, PA.—The Beacon Light Company has had plans prepared for a new turbine building and switching station.

CLIFTON HEIGHTS, PA.—The Caledonia Woolen Mills has completed plans for an addition to its power house.

ERIE, PA.—The Erie Lighting Company is having plans prepared for a new substation. Day & Zimmerman, of Philadelphia, are the architects.

HALIFAX, PA.—The City Council has granted the Millersburg (Pa.) Electric Light, Heat & Power Company a franchise for furnishing energy for street lighting. F. S. Kirk, general manager of the company, announces that service would be installed by the first of the year.

HARRISBURG, PA.—The Springfield Township Light & Power Company, the East Springfield Borough Light & Power Company, and the Trevose Light Company have filed incorporation applications with the Public Service Commission for permission to operate in Springfield and vicinity, and Trevose, respectively.

HARRISBURG, PA.—Charters for 23 electric companies to operate in central Pennsylvania have been approved recently. Sixteen were incorporated by P. T. Davis, A. J. Musser and M. S. Mitchell, of Clearfield, to supply electricity from Bellefonte. The capitalization is $5,000 each. W. S. Harris, Rees Kintzing and H. S. Furst, of Lock Haven, incorporated the Bald Eagle Electric Light Company for Bald Eagle Township Clinton County, and the Mill Hall and Flemington companies for the boroughs in Clinton County. John P. Rawson, Willard C. Sharp and Oscar Wagner, of Scranton chartered the Bell Township, Winslow Township and McCalmont Township Light & Power companies to operate in districts of these names in Jefferson County.

HAZELTON, PA.—The Harwood Electric Company is erecting a 22,000-volt transmission line from Mahanoy City to Frackville.

MILLERSBURG, PA.—A charter has been granted to the Upper Paxton Township Electric Light, Heat & Power Company of this city, to supply electrical energy for light, heat and power in Upper Paxton Township. The capitalization is $5,000, and the incorporators are Farley Gannett, of Harrisburg, and others.

NEWTOWN SQUARE, PA.—The American Telephone & Telegraph Company will build an addition to its local operating station.

PHILADELPHIA, PA.—The Department of Public Works will receive bids up to October 3 for two pumps for the water department, one with a daily capacity of 25,000,000 gallons for Queen Lane Station, the other with a capacity of 35,000,000 gallons per day for Lardner's Point Station.

PHILADELPHIA, PA.—The Philadelphia Electric Company will soon commence the erection of a new generating station on a site recently acquired at South Chester, to be operated by its subsidiary organization, the Beacon Light Company. The new plant will be constructed in two units, with a total capacity of 120,000 kilowatts, and is estimated to cost $6,000,000. It is planned to have the first unit of the station ready for operation in September, 1917, and the second unit early in 1918.

WOODBURY, PA.—The City Council has started a movement for the establishment of a municipal electric-lighting plant.

ROANOKE, VA.—The Roanoke Railway & Electric Company is preparing to double the output of its plant, plans providing for the installation of 500-kilowatt generating units, four new boilers, coal-conveying and handling system, condensers, pumps, etc., the construction of a substation and erection of two 11,000-volt transmission lines to the Viscose Company's plant. The principal contracts have been awarded. The cost of the work is estimated at $250,000.

WILLIAMSBURG, VA.—The City Council has awarded a franchise for furnishing light and power here to E. H. Clowes and associates, of Richmond. A street-lighting system, consisting of 50 units, will be installed, and construction of the plant and distribution system will be commenced at once.

PARKERSBURG, W. VA.—Reduced from $2,000,000 to $1,700,000, the application of the Kanawha Traction & Electric Company to issue five-per-cent bonds has been granted by the State Public Utilities Commission. The bonds are to be sold at not less than 86. Of the amount, $1,100,000 is to be used to retire two-year generating system notes, $40,000 in improvements in the property in Parkersburg, $33,000 to construct a reinforced concrete viaduct at Boaz, W. Va., and the remainder to retire notes falling due.

McCORMICK, S. C.—The Isolated Light & Power Company, recently organized, has applied for a franchise to operate an electric-lighting plant to furnish energy for light and power here.

TAMPA, FLA.—A survey for the proposed electric railway, to be built by the Tampa & St. Petersberg Railway Company running from Tampa to St. Petersburg, about 18 miles, will be made by C. E. Burleson, of St. Petersberg. G. S. Gandy, of St. Petersberg, is president.

TARPON SPRINGS, FLA.—The Tarpon Springs Electric Company, J. R. Crellin, superintendent, has closed a contract with the City Council for the installation of an ornamental lighting system on Tarpon Avenue.

NORTH CENTRAL STATES.

AMANDA, O.—A representative of the Sciota Valley Traction Company has contracted for a franchise to erect a distribution system to furnish energy here for heating and lighting purposes.

CLEVELAND, O.—Fielder Sanders, municipal traction commissioner, has recommended to the City Council that the Cleveland Railway be permitted to contract with the Cleveland Electric Illuminating Company for power. This will result in the abandonment of the Cedar Avenue power house and the construction of a substation at an estimated cost of $250,000.

COLUMBUS, O.—The Columbus Railway, Power & Light Company is erecting a 13,000-volt transmission line to the plant of the Brunt Tile & Porcelain Company, which company formerly operated an isolated power plant. New motors and equipment will be installed when the transmission line is completed.

COLUMBUS, O.—The Columbus Railway Power & Light Company has been making an active campaign for industrial power business since the first of the year, and as a consequence of the increase in this class of business is preparing to add 7,500 kilowatts generating capacity to its central station. In addition a new 1,500-kilowatt generator also will be installed.

MIDDLETOWN, O.—The State Utilities Commission has authorized the Ohio Gas & Electric Company to issue $103,000 in bonds, the proceeds to be used for the construction of a transmission line from Cincinnati to this city.

OXFORD, O.—A referendum vote will be taken on the proposition of rehabilitating the municipal electric-lighting plant or contracting for special service from Richmond. Howard Ashe is bidding for the lighting contract, the energy to be furnished by the Richmond municipal plant.

ST. BERNARD, O.—A petition has been circulated asking for an ordinance providing for a $90,000 bond issue for improvements and extensions to the electric lighting and water works plants here.

SEBRING, O.—An option has been taken by Mr. Monroe, of Lisbon, on the electric-lighting system of Sebring. The option is for 90 days. If the option is closed the company represented by Mr. Monroe proposes to greatly enlarge the Sebring plant and better the system.

ZANESVILLE, O.—Property owners on Fifth Street are planning to secure a boulevard lighting system.

CHARLESTOWN, IND.—The Louisville & Northern Railway & Lighting Company is rebuilding the electric distribution system here, in accordance with a contract recently entered into, and will provide a continuous service.

CROWN POINT, IND.—The Interstate Public Service Company is contemplating an addition to its electric-lighting plant.

GARY, IND.—The Public Service Commission has granted authority to the Calumet Electric Company, of Gary, to issue $65,000 in bonds, for the purpose of constructing its proposed high-tension transmission line from East Gary to Crown Point.

MUNCIE, IND.—It was erroneously stated in last week's issue that bids were being received for the plant of the Muncie Electric Light Company. These bids had reference to the municipal electric-lighting plant, for which bids have been submitted by the Muncie Electric Light Company and John Stockdale, of Anderson.

ROCKFORD, ILL.—The report of Dabney H. Maury, of Chicago, Ill., investigating engineer, and the Water Works Committee, as read at a recent meeting of the City Council, recommends that the city build and operate its own light and power system. The erection of a power plant with the necessary equipment is estimated to cost $425.000.

SPRINGFIELD, ILL.—At a meeting of the City Commission, November 7 was the date fixed for voting on the proposition whether the city of Springfield shall purchase a reserve generator.

STREATOR, ILL.—It is reported that the Public Service Company plans making extensions and improvements to its local plant this fall.

PORT HURON, MICH.—The Detroit Edison Company has purchased 690 feet of St. Clair River frontage at Bunce Creek, near here. The company proposes to erect a substation, and will furnish energy for the Rapid railway and for street lighting in St. Clair, Capac and other towns in the Thumb district.

ALMA, WIS.—The Wisconsin-Minnesota Light & Power Company is considering the extension of its transmission lines through this section of the country, to furnish energy for power and lighting.

MILWAUKEE, WIS.—Commissioner F. G. Simmons has called for new bids on concrete post shafts and brackets for the municipal electric-lighting system.

WAUPACA, WIS.—The final steps in the transfer of the Waupaca Light & Railway Company's property, including the electric-lighting plant, the electric railway from this city to the Chain o' Lakes, and all assets of the company to E. A. Aspennes, of Montevideo, Minn., and Truman Hibbard, vice-president and general manager of the Electric Machinery Company, of Minneapolis, Minn., have been made. The new company will assume management of the plant on November 1.

ECHO, MINN.—The city is contemplating the installation of a 30 to 50-horsepower crude-oil engine in the near future. It is also planned to change the system to alternating current.

MINNEAPOLIS, MINN.—The Northern States Power Company is building a steel-tower transmission line from a point north of this city to the Wisconsin state line near Stillwater, Minn. The line is being built to connect with a transmission line under construction by the Wisconsin-Minnesota Light & Power Company, over which a large amount of the electrical energy produced by the new hydroelectric plant at Chippewa Falls will be delivered to the Northern States Power Company.

ZUMBROTA, MINN.—Construction of the 21-mile high-tension transmission line by the Northern States Power Company from Zumbrota to Pine Island and West Concord is practically completed, and work is starting on an 11-mile line connecting Mantorville and Kasson to the main transmission system of the compay.

BURLINGTON, IOWA.—A company is being organized to build a belt-line electric railway to connect Burlington, Ft. Madison and Keokuk. E. D. Cleary is interested in the project.

COUNCIL BLUFFS, IOWA.—Manager A. L. English of the Citizens Gas & Electric Company, whose five-year contract with the city expires October 1, has asked the City Council to appoint a committee of five to confer with the company on a new contract.

DES MOINES, IOWA.—The streets and road committee of the Chamber of Commerce has been instructed to make investigations for the flood lighting of public buildings in this city. George A. Fields is a member of the committee.

ROYAL, IOWA.—The County Commissioners are planning to issue bonds to pay for improvements to the electric-lighting and waterworks systems.

TORONTO, IOWA.—A franchise has been granted to the Iowa Electric Company for supplying electric service here.

LEES SUMMIT, MO.—L. K. Greene & Sons have filed an application with the Public Service Commission for authority to purchase the holdings of the Lees Summit Light & Power Company for $19,000.

LIBERTY, MO.—A petition is being circulated asking the City Council to look into the matter of the purchase of the present city electric-lighting plant or the installation of a municipal plant.

ATHOL, KAN.—The local electric-lighting plant has been purchased by A. C. Mead.

BONNER SPRINGS, KAN.—Authority to issue $30,000 in bonds has been granted to the Bonner Springs Gas & Electric Company by the Public Utilities Commission. Bonds in the sum of $20,000 will be used for the purchase of the property of the newly organized company, in which Elmer Strain, of Topeka, is interested. The other $10,000 is to be used for extensions and improvements.

HUTCHINSON, KAN.—Foundations have been completed for the addition being made to the plant of the United Water, Gas & Electric Company on Sherman Street. With the completion of the addition and the installation of the new generating equipment the company will be able to supply the increasing demands for energy here, and will furnish service to the towns of Lyons and Inman and intervening rural community.

DATES AHEAD.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 9-12. Secretary, E. B. Burritt, 8 West Fortieth Street, New York City.

Electrical Supply Jobbers' Association. Quarterly meeting, Hotel Statler, Cleveland, O., October 10-12. Secretary, Franklin Overbaugh, 411 South Clinton Street, Chicago, Ill.

New Mexico Electrical Association. Executive meeting, El Paso del Norte Hotel, El Paso, Tex., October 15-17. Secretary pro tem, E. A. Thiele, 112 West Third Street, Roswell, N. M.

New England Section, N. E. L. A. Annual convention, Pittsfield, Mass., October 17-20. Secretary, O. A. Bursiel, 149 Trenton Street, Boston, Mass.

Jovian Order. Annual convention, Indianapolis, Ind., October 18-20. Secretary, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 27-28. Secretary, R. H. Starrett, 195 Broadway, New York City.

MINTO, N. D.—Plans are being made for the installation of a white-way system in Harvey, Avenue.

SOUTH CENTRAL STATES.

GREENVILLE, KY.—The sale of a franchise for operation of a light and water plant here has been ordered for October 2 by the City Council. The Greenville Light & Water Company has been operating for eight years, and its franchise has 12 years to run. The action of the Council is a surprise to the community.

HENDERSON, KY.—The City will receive sealed bids until October 17 for the sale and granting of a franchise to construct and operate an electric street railway on certain streets for a period of 20 years.

LEXINGTON, KY.—The Kentucky Utilities Company was the purchaser of the lighting plants at Morganfield and Uniontown, Ky., recently sold by A. L. Carpenter and Ross Lucas, according to a statement by President Harry Reid. The company, he said, is negotiating for other plants in western Kentucky.

LOUISVILLE, KY.—The new Highland substation of the Louisville Gas & Electric Company is now being placed in commission. This station has a transformer capacity of 2,000 kilowatts, and is designed so that the capacity may be increased to 6,000 kilowatts. The load for this entire district, including part of the county, and the street lighting system, will be transferred to this station.

MT. STERLING, KY.—The plan of the city administration to establish a municipal lighting plant is hanging fire, while the Kentucky Utilities Company has presented a proposition which the City Council is considering. It provides for a trial installation on one street of the identical lights specified in the plans for the municipal plant, with the understanding that the same service would be supplied for the whole city. The Kentucky Utilities claims that it can provide the service cheaper than the city can.

SPRINGFIELD, TENN.—The city contemplates improving its electric-lighting plant. C. E. Bell is mayor.

GULFPORT, MISS.—The Mississippi Centennial Exposition Commission will receive suggestions until October 8 for a lighting plant for the Mississippi Centennial Exposition. A contract will be awarded to the firm making the accepted plans and specifications.

POCAHONTAS, ARK.—Bids will be received this week for one 75-horsepower and one 20-horsepower motor for installation in a waterworks plant to be erected here. E. Dalton is chairman of the waterworks commission.

McALESTER, OKLA.—The Choctaw Power & Light Company, of this city, is installing a high-tension line to Wilburton, about 30 miles, for furnishing energy for the operation of several coal mines in that district.

DALLAS, TEX.—It is reported that the General Electric Company, through Charles W. Hobson, of Dallas, has obtained a lease on the Oak Cliff lines of the Northern Texas Traction Company, and that extensions and improvements will be made to the property.

PARIS, TEX.—The Paris Transit Company has increased its capital stock from $60,000 to $80,000.

SWEETWATER, TEX.—The West Texas Electric Company will enlarge its electric light and power plant here. It has just increased its capital stock from $300,000 to $500,000.

WICHITA, FALLS, TEX.—The Wichita Falls Electric Company has increased its capital stock from $700,000 to $775,000. It will make improvements to its plant.

WESTERN STATES.

BUTTE, MONT.—F. M. Kerr, general manager of the Montana Power Company, who has just completed a tour of inspection of the company's plants, made an announcement that construction of the new plant at Wolf Creek, which will have a capacity of 53,000 horsepower, is progressing rapidly and that he expects the plant to be in operation in about a year.

COLORADO SPRINGS, COLO.—Mayor McKesson has announced that a complaint has been filed with the Public Utilities Commission setting forth facts regarding the inadequacy of the present street-lighting system. A modern system is advocated.

DENVER, COLO.—The public library is to be illuminated by a flood-lighting system. Plans for the system are under way, and actual work will begin soon.

LYONS, COLO.—Last week a celebration was held in honor of the opening of the electric-lighting plant here. The new street-lighting system consists of 13 lamps installed at a cost of $4,000. William Sydow is chief engineer of the plant, and Roy Salisbury, of Denver, was consulting engineer.

DOUGLAS, ARIZ.—The plans adopted by the City Council for the proposed ornamental lighting system call for cast-iron posts.

PHOENIX, ARIZ.—The City Commission has adopted an ordinance calling a special election on October 23 to vote on bonds in the sum of $600,000 to provide for the construction of a municipal electric-lighting plant.

COALVILLE, UTAH.—The City Council has been authorized to sell the municipal electric lighting plant. The Utah Power & Light Company will probably purchase the plant, which originally cost $15,000. The company is now building a high-tension transmission line to this city.

RENO, NEV.—The Nevada Telephone & Signal Company has been incorporated with a capital stock of $250,000. F. M. Manson, of Reno, is president; Adrian Ellis, of Salt Lake, is vice-president; J. T. Goodwin, of Lovelock, is treasurer, and H. L. Thomas, superintendent. Work on the new line has started at Winnemucca and will be pushed to completion. Work on the Reno end of the line will commence in a few days to connect up with Humboldt County points, and meanwhile work will be done out of Tonopah.

TONOPAH, NEV.—Oscar Daube and associates have announced their intention of constructing a power plant on property recently purchased by them near this city.

HAILEY, IDAHO.—Extensive repairs are being made to the plant of the Hailey Electric Company.

CLE ELUM, WASH.—Bonds in the sum of $5,000 have been voted for the installation of an electric-lighting system here.

PE ELL, WASH.—The City Council is considering ways and means for securing energy for street lighting. There have been two electric franchises granted to private concerns in recent years, but neither concern is now furnishing energy for street lighting. The Council will endeavor to dispose of both franchises in order that new companies may be brought into the field.

HOOD RIVER, ORE.—Condemnation proceedings have been instituted by the Pacific Power & Light Company, of Portland, to secure possession of a site on the Columbia River upon which to erect a cable tower to connect the company's lines at White Salmon with those in Hood River. The company has two power plants on Hood River which are connected by a high-tension line to The Dalles and to the company's plant on White River.

KLAMATH FALLS, ORE.—According to plans of the United States Reclamation Service the waters of Link River within the city of Klamath Falls are to be used and a dam constructed across the head of the river. The Service has been planning the development of the vast water power now going to waste, but was hampered because of the lack of sufficient appropriations.

EUGENE, ORE.—At a recent meeting here plans were discussed for extensions to the plants of the Northern Idaho & Montana Power Company and the Oregon Power Company. It is announced the improvements will be started within a few weeks.

COLUSA, CAL.—City officials are investigating other municipal electric-lighting systems with a view to establishing a plant here.

FULLERTON, CAL.—Plans to illuminate the streets of this city by means of an ornamental lighting system have been dropped temporarily by the City Council.

GRASS VALLEY, CAL.—Plans have just been made public by General Manager George W. Starr, of the Empire and Pennsylvania gold mines, for an electric road to connect the two mines. The road, which will be operated by trolley system, will be one mile long.

OROVILLE, CAL.—It is expected the transfer of the properties of the Oro Electric Corporation to the Pacific Gas & Electric Company will be completed within 30 days.

OROVILLE, CAL.—This city is considering the acquisition of its lighting system. It is estimated that an adequate system could be installed for about $25,000.

PETALUMA, CAL.—Plans are under way for the formation of the Wilson public highway lighting district.

RIVERDALE, CAL.—The County Supervisors will receive bids up to October 3 for installing and maintaining lights in the Riverdale lighting district.

RIVERSIDE, CAL.—Several extensions of electrical distributing lines have been ordered here.

RIVERSIDE, CAL.—The City Electric Supply Company of this city has secured the contract for electric transmission lines, substation work and other construction for the Lindsay-Strathmore irrigation project at $31,000.

SONORA, CAL.—Articles of incorporation have been filed for the Yosemite Power Company, with a capital stock of $10,000,000, by J. C. Hayes, L. R. Wiley and Albert Raymond.

TULARE, CAL.—A petition has been presented to the City Trustees asking for the formation of an assessment district to provide for the intallation of a new lighting system in the business section of the city.

VALLEJO, CAL.—The Vallejo Electric Light & Power Company has been awarded the contract for wiring the Levee Building at $4,000.

Financial Notes

The Wisconsin Railroad Commission has authorized the Wisconsin-Minnesota Light & Power Company, a subsidiary of the American Public Utilities Company, to issue $312,500 of preferred stock and $750,000 of five-per-cent bonds.

A meeting of the board of directors of the Pacific Gas & Electric Coompany has been called for September 30, to declare quarterly dividend at the rate of $1.25 per share upon the common stock, which will be payable October 16 to stock of record September 30.

The National Light & Power Company, of New Jersey, Jersey City, has filed a certificate of change, reducing its capital stock from $30,000 to $6,000. All of the outstanding and issued common stock of the company is to be surrendered for cancellation, each shareholder to receive his pro rata number of shares of decreased common stock and his proportion in cash.

The New York Upstate Public Service Commission has authorized the Ithaca Gas & Electric Corporation to issue $67,600 of its common stock, to be sold at par, to the Associated Gas & Electric Company. Proceeds are to be used to reimburse the treasury of the subsidiary company for expenditures made for capital account, to pay $5,000 accrued taxes and to provide $41,000 additional working capital.

The Utah Savings & Trust Company has been appointed the Salt Lake City transfer agent for the preferred stock of the Utah Power & Light Company, and the Tracy Loan & Trust Company has been appointed local registrar, it having been found necessary to open up in Salt Lake City a stock transfer office in order to insure the prompt transfer of stock certificates in the interest of the growing number of stockholders in that section.

Offering to shareholders of $7,891,050 additional stock of New England Telephone has worked out an entire success. The stock was all taken, and it is probable that at least 75 per cent of the stock will be full paid on the first installment. Had stockholders desired they might have paid for 50 per cent on March 31, 1917. The New England company will make a very small gain in stockholders as the result of this financing. In other words, the present 5,000 stockholders have taken more than 90 per cent of the issue.

Transfer of all physical property and franchises from the North Shore, Racine & Milwaukee Electric Railway Company to the Chicago, North Shore & Milwaukee Electric Railroad Company has been filed in Milwaukee. This completes final details in reorganization of the Chicago & Milwaukee Electric Railroad Company. The purchasing company takes over $1,036,000 of receivers' certificates. Since the new company assumed charge of the property net earnings have been increasing at the rate of $30,000 monthly.

Dividends.

	Term.	Rate.	Payable.
Am. Pub. Serv., pf.	Q	1.75%	Oct. 1
Am. Tel. & Tel.	Q	2 %	Oct. 16
Ark. Lt. & Pw., pf.	Q	1.75%	Oct. 2
Bangor Ry. & Elec., pf.	Q	1.75%	Oct. 2
Cal. Elec. Gen., pf.	Q	1.5 %	Oct. 2
Cent. Ill. Pub. Serv., pf.	Q	1.5 %	Oct. 15
Cin. St. Ry.	Q	1.5 %	Oct. 2
Cities Service, com.	M	0.5 %	Nov. 1
Cities Service, pf.	M	0.5 %	Nov. 1
City Ry., Chicago	Q	2 %	Sept. 30
Colo. Spgs. Lt., Ht. & Pw., pf.	Q	1.5 %	Sept. 30
Col. Ry., Gas & Elec., pf.	Q	1.5 %	Oct. 1
Col. N. & Z., pf.	Q	1.5 %	Oct. 1
Elmira W., Lt. & R.R., second pf.	Q	1.25%	Sept. 30
Green. & Coates, Phila.	Q	$1.50	Oct. 7
Harrisburg Lt. & Pw., pf.	Q	1.5 %	Sept. 30
Int. Trac., Buff.	—	1 %	Sept. 30
Int. Trac., Buff., first pf.	Q	1.75%	Sept. 30
Int. Trac., Buff., pf.	Q	1 %	Sept. 30
Iowa Ry. & Lt., pf.	Q	1.75%	Sept. 30
Kans. Gas & Elec., pf.	Q	1.75%	Oct. 2
Ky. Secur., pf.	Q	1.5 %	Oct. 15
Ky. Secur., acct. ac. div.	—	0.5 %	Oct. 15
Lancas. Co. Ry. & Lt., pf.	Q	1.25%	Sept. 30
Louisville Trac.	Q	1 %	Oct. 1
Louisville Trac., pf.	—	2.5 %	Oct. 1
Montreal Tel.	Q	2 %	Oct. 6
Montreal Tel., extra	—	0.25%	Oct. 6
New Eng. Tel. & Tel.	Q	1.75%	Sept. 30
New Orl. Ry. & Lt., pf.	Q	1.75%	Sept. 30
Northwest. Elec., pf.	Q	1.5 %	Oct. 2
Omaha & C. B.	Q	1 %	Oct. 1
Omaha & C. B., pf.	Q	1.25%	Oct. 1
Pac. Tel. & Tel., pf.	Q	1.5 %	Oct. 15
Phila. Rap. Tran.	—	2 %	Oct. 11
P. R. Rys., pf.	Q	1.75%	Oct. 2
Prov. Tel.	Q	$1	Sept. 30
Pub. Serv. Corp. of N. J.	Q	2 %	Sept. 30
Republic Ry. & Lt., pf.	Q	1.5 %	Oct. 14
So. Cal. Edison, com.	Q	1.75%	Nov. 15
So. Util., pf.	Q	1.75%	Oct. 2
Southwest. Cities Elec., pf.	Q	1.75%	Oct. 1
Spgfd. & X., pf.	Q	2 %	Sept. 30
Stark Elec.	Q	1 %	Oct. 1
Tidewater Pw.	—	3.5 %	Oct. 1
U. G. & E. Corp., first pf.	Q	1.75%	Oct. 1
Va. Ry. & Pw., com.	Q	1.5 %	Oct. 20
Wash. Water Pw.	Q	$1	Oct. 1
York Rys., pf.	Q	1.25%	Sept. 30
Youngstown & Ohio R., pf.	Q	1.25%	Sept. 30
Youngstown & Ohio R., acct. ac. div.	—	0.75%	Sept. 30

Reports of Earnings.

WESTERN UNION TELEGRAPH.

Western Union Telegraph Company reports to Massachusetts Public Service Commission for year ended June 30, 1916, as follows:

	1916	1915
Operating income	$56,054,199	$48,076,325
Total operating expenses	38,697,382	34,953,115
Net revenue	17,356,817	13,123,210
Uncollected operating revenue	273,301	311,635
Taxes	1,279,500	1,209,000
Operating income	15,804,016	11,602,574
Total non-operating income	17,348,194	12,524,464
Total deductions	5,204,321	5,090,490
Net income	12,143,873	7,433,973

Total surplus on June 30, 1916, as per balance sheet was $22,865,519, compared with

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Sept. 25.	Sept. 18.
American Tel. & Tel. (New York)	133	132¾
Commonwealth Edison (Chicago)	145½	142
Edison Electric Illuminating (Boston)	240	238
Electric Storage Battery common (Philadelphia)	71½	66
Electric Storage Battery preferred (Philadelphia)	71½	66
General Electric (New York)	174½	170½
Kings County Electric (New York)	130	130
Massachusetts Electric common (Boston)	5½	5½
Massachusetts Electric preferred (Boston)	36	36
National Carbon common (Chicago)	190	185
National Carbon preferred (Chicago)	—	122
New England Telephone (Boston)	129	128
Philadelphia Electric (Philadelphia)	28¾	28¾
Postal Telegraph and Cables common (New York)	85½	85¼
Postal Telegraph and Cables preferred (New York)	66⅝	66½
Western Union (New York)	101¼	101½
Westinghouse common (New York)	63⅞	63½
Westinghouse preferred (New York)	72	70

$15,664,930 at same time last year, $9,744,616 in 1914 and $9,532,626 in 1913.

Total value of marketable securities owned on June 30, 1916, was $14,331,605, an increase of $11,025,768 over same time last year. During the year the company purchased $1,721,431 Anglo-French five-per-cent bonds, $4,700,000 195 Broadway Corporation notes; also $900,000 of the corporation's stock, increased its investment in Pennsylvania Railroad 4½s from $490,059 to $1,971,000, purchased $586,928 additional Baltimore & Ohio bonds and bought $956,875 Chicago, Milwaukee & St. Paul 4s. The Western Union disposed of $884,000 New York City one-year six-per-cent notes and also $616,000 of the city's revenue bonds.

Investment securities item on June 30 last was $11,175,286, a decrease of $1,951,838 from a year ago. These securities are those of various subsidiary companies.

PACIFIC GAS & ELECTRIC.

	1916	1915
July gross	$1,424,288	$1,482,707
Net after taxes	606,875	602,545
Total income	648,648	637,971
Surplus after charges	310,460	307,913
Seven months' gross	10,765,729	10,686,205
Net after taxes	4,522,017	4,606,700
Total income	4,798,263	4,823,997
Surplus after charges	2,431,465	2,383,777
Balance after preferred dividends	1,630,083	1,745,968
Twelve months' gross	18,609,825	17,845,001
Net after taxes	7,860,025	7,604,249
Total income	8,332,853	7,994,941
Bond and note interest	3,900,718	4,061,953
Bond and note discount	171,680	292,596
Surplus	4,260,455	3,590,392
Preferred dividends	1,253,030	902,792
Balance	3,007,425	2,687,600

COMMONWEALTH POWER, RAILWAY & LIGHT.

	1916	Per Cent Gain Over 1915
August gross	$1,358,867	11.74
Net	667,860	10.78
Surplus after charges	174,133	8.66
Balance after preferred dividends	86,783	8.12
Eight months gross	10,826,081	16.87
Net	5,585,870	16.74
Surplus after charges	1,641,543	22.42
Balance after preferred dividends	976,393	39.30
Twelve months gross	16,152,529	14.13
Net	8,426,386	14.81
Surplus after charges	2,596,224	18.61
Balance after preferred dividends	*1,611,074	31.09

*Equivalent to 8.74 per cent on the common stock.

Fixed charges of Commonwealth Power, Railway & Light include dividends on all outstanding preferred stocks of subsidiary companies as well as interest and taxes.

CITIES SERVICE.

	1916	1915
August gross	$ 628,104	$ 312,737
Net	603,602	298,170
Surplus after charges	603,602	257,336
Balance after preferred dividends	407,919	126,503
Eight months gross	5,365,449	2,696,021
Net	5,207,962	2,585,054
Surplus after charges	4,943,013	2,258,448
Balance after preferred dividends	3,563,970	1,201,784
Twelve months gross	7,149,228	4,051,578
Net	6,929,791	3,895,732
Surplus after charges	6,509,509	3,405,732
Balance after preferred dividends	*4,599,124	1,817,736

*Equivalent to 26.74 per cent earned on common stock, compared with 12.27 per cent for 12 months ended August 31, 1915.

Gross of subsidiary properties for 12 months ended July 31, 1916, was $28,099,330, compared with $20,505,861 for 12 months ended July 31, 1915.

COLUMBIA GAS & ELECTRIC.

	1916	1915
August gross	$ 584,587	$ 515,175
Net after taxes	263,795	219,967
Total income	315,615	268,055
Deficit after charges	27,092	70,032
Eight months' gross	5,901,896	5,349,410
Net after taxes	3,024,606	2,662,083
Total income	3,372,457	2,988,508
Lease rentals and other prior charges	2,257,143	2,242,048
Charges Columbia Gas & Electric	462,385	457,605
Surplus	652,930	288,855

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 22,447. WIRELESS APPARATUS.—An American consular agent in Ecuador asks to be supplied with names and addresses of American manufacturers of wireless apparatus. Full information should be sent at once.

NO. 22,449. ELECTRICAL GOODS.—A firm in the United States writes the Bureau that a Cuban merchant who is now in the United States wishes to secure exclusive agencies for the sale of the following commodities in Cuba: Magnets, motors, and electrical and automobile accessories.

NO. 22,469. HEATING AND LIGHTING APPARATUS.—A merchant in France informs an American consular officer that he desires to be placed in communication with American manufacturers and exporters of heating and lighting apparatus. Correspondence, printed matter, etc., should be in French.

NO. 22,481.—MICA, FLUORSPAR AND ANTIMONY.—The Bureau is in receipt of a letter from a business man in Mexico who wishes to find a market in the United States for mica, fluorspar and antimony.

Proposals

ELECTRIC-LIGHTING PLANT.—Bids will be received by the Board of Public Works, Havana, Fla., until October 23, for the construction of a municipal electric-lighting plant and waterworks system.

WIRING.—Sealed bids will be received by the Board of Administration in its office in the Capitol Building, Springfield, Ill., October 3, for light and power wiring at the State Colony for Epileptics, near Dixon, Ill. Plans and specifications for the above named improvement may be obtained from James B. Dibelka, State Architect, 130 North Fifth Avenue, Chicago, Ill.

ELECTRICAL EQUIPMENT.—Bids for filter plant at Trenton Mo., will be received October 11. The specifications include two 1,000-gallon-per-minute centrifugal pumps, with one 10-horsepower motor and one 20-horsepower motor; furnishing and installing one Unalow steam engine direct connected to a 62.5-kilovolt-ampere generator, and furnishing a switchboard for generator above mentioned. J. H. Flesher, City Clerk.

POLE-LINE MATERIAL.—Bids will be received by the Village Council of Kasson, Minn., until October 2, for the following material: 50 eight-pin fir crossarms, 75 six-pin crossarms, 1,000 locust pins, 1,000 glass insulators, 1,000 pounds No. 6 weatherproof wire, seven five-kilowatt and four 7.5-kilowatt transformers (2,200 volts primary, 110-220 volts secondary), 28 compression-type lightning arresters, 14 pipe grounds, 28 choke coils, 500 feet of guy wire and 25 porcelain strain insulators. W. D. Ringland, Recorder.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 137, Brooklyn, N. Y., and Mare Island, Cal., two electric bake ovens. Schedule 167, Norfolk, Va., two motor and turbine-driven centrifugal pumps. Schedule 168, Norfolk, Va., one **motor-generator set.** Schedule 170, one electric **spot-welder.** Bidders desiring to submit proposals should make application immediately for schedules to the Bureau, or to the purchasing office nearest to navy yard where delivery is to be made.

New Incorporations

HOWELL, MICH.—Howell Electric Motors Company has increased its capital stock from $30,000 to $100,000.

NEW YORK, N. Y.—Artificial Daylighting Company. Capital, $50,000. Deal in fixtures and lighting equipment. Incorporators: I. B. Lewis, I. Mulcay, and C. Swanson.

NEW FREEDOM, PA.—American Insulator Company. Capital, $150,000. Incorporators: H. C. Kugler and others.

MILWAUKEE, WIS.—Wellington Electric Company. Capital, $25,000. Incorporators: Henry F. Wellington, Lucas Kropfel and Carl H. Juergens.

JERSEY CITY, N. J.—Baltimore Electric Talking Sign Company. Capital, $150,000. Incorporators: Charles J. Formley, John H. Patterson and Benjamin E. Gordon.

SHERIDAN, WYO.—Crescent Electric Company. Capital, $10,000. Dealing in electrical supplies. Incorporators: J. S. Backus, B. L. Conley and E. C. Conley.

ARLINGTON, N. J.—Universal Electric Company. Capital, $25,000. Manufacture electrical machinery. Incorporators: C. T. Westlin, G. O. Westlin and Frank Koch.

CINCINNATI, O.—Cincinnati Storage Battery Company. Capital, $30,000. Incorporators: A. H. Luhrman, W. T. Foley, E. M. McDonald and others.

BOSTON, MASS.—The Bernard Kapstein Company. Capital, $25,000. Deal in electrical supplies. Incorporators: Joseph Bearson, Edward M. Kapstein and E. I. Newstadt.

ROCHESTER, N. Y.—Industrial Electric Company. Capital, $15,000. Engage in general electrical business. Incorporators: H. W. Davison, T. T. Benz, E. F. Davison and G. W. Brotsch.

PATERSON, N. J.—Farm Lighting & Power Company. Capital, $10,000. Sell and lease electric, gas and oil machines for light, heat and power. Incorporators: Edwin and Carl Katz, of Paterson, and F. A. Meade, of Bayonne.

DOVER, DEL.—Gaston, Williams & Wigmore Electrical Engineering Corporation. Operate general electrical engineering and contracting business. Capital, $100,000. Incorporators: C. K. Fauver and J. A. Wigmore, Cleveland, O.; M. J. Budlong, A. J. Mace, and R. R. Lee Martin, New York City.

Electrical Patents Issued September 19, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,198,419. Means for Controlling Dangerous Gases in Submarines and Other Craft. J. M. Clark, Whitestone, N. Y. For disposing of gases from storage batteries.

1,198,426. Production of Electrode Elements. T. A. Edison, assignor to Edison Storage Battery Co., West Orange, N. J. Process of loading a tubular storage-battery element.

1,198,449. Storage Battery. M. R. Hutchison, assignor to Edison Storage Battery Co., West Orange, N. J. Special provision for removing the electrolyte.

1,198,462. Machine for Marking Buttonhole Files. R. L. Lloyd, Portsmouth, and R. D. Simpson, Columbus, O., assignors to United Shoe Machinery Co., Paterson, N. J. Marking members are electrically heated to cauterizing temperature.

1,198,463. Combined Shoe-Cutting Pattern and Marker. R. L. Lloyd, Portsmouth, and R. D. Simpson, Columbus, O., assignors to United Shoe Machinery Co. Has electrically heated wire for marking purposes.

1,198,466. Vehicle Headlight. C. F. MacDonald, Cleveland, O. Electrically operated mechanism intermittently tilts reflector.

1,198,477. Combination Egg-Testing Machine. J. F. Pfeifle, Youngstown, O. Special egg carrier and arrangement of light bulb and reflector.

1,198,483. Shield Attachment for Incandescent Lamps. J. F. Scott, Indianapolis, Ind. Support for bowl-shaped shield about lower end of bulb. (See cut, next page.)

1,198,495. Signal Attachment for Automobiles and the Like. C. Wende, St. Louis, Mo. Direction indicator.

1,198,500. Wire Terminal. E. C. Wilcox, assignor to Connecticut Telephone & Electric Co., Meriden, Conn. Terminal connector for insulated wire or cable.

1,198,508. Refillable Cartridge Fuse. E. Alexander, Burlingame, Cal. Details of end caps supporting a ribbon fuse.

1,198,517. Signal Apparatus for Automobiles. F. L. Bixby, State College, N. M. Direction indicator.

1,198,578. Magneto Top. G. H. Reimer,

assignor to Patent Novelty Co., Fulton, Ill. Momentum disk top causes metal snake to move on cover of casing by magnetic attraction.

1,198,586. Electromagnetic Recording Device. A. P. Sanborn and R. C. Wilson, Ossining, N. Y., assignors of one-third to H. R. Horton, Haymount, N. Y. Has a chronometer chart with an electromagnetically operated punch.

1,198,616. Method of Heating Carbon Articles in Independent Units. J. W. Brown, assignor to National Carbon Co., Cleveland, O. Method of operating electric furnaces of the resistance type.

1,198,618. Process of Making Brass and Copper Alloys. G. H. Clamer, Philadelphia, Pa. Employs an electric furnace.

1,198,619. Dry-Cell. W. R. Clymer, assignor to National Carbon Co., Cleveland, O. Process of impregnating a dry-cell with electrolyte.

1,198,625. Electric Furnace. J. L. Dixon. Detroit, Mich. Transformer connections and arrangement for operating from three-phase supply.

1,198,626. Steel Furnace. J. L. Dixon. Modification of above.

1,198,657. Lamp Reflector. B. H. Pomeroy, assignor to R. E. Dietz Co., New York, N. Y. Particular structure for headlight.

1,198,658. Time-Limit Indicator. H. R. Pope, Franklin, Pa. Mechanism for timing closure of contacts.

1,198,659. Trolley. C. O. Reardon, Oakland, Cal. Device for securing harp to pole.

1,198,660. Flashlight. A. C. Recker, assignor to Waterbury Mfg. Co., Waterbury, Conn. Special switch structure of usual tubular device having metallic casing.

1,198,671. Automobile Signal. E. T. Sherman, assignor to Sherman Crane Automobile Signal Co., Denver, Colo. Arrangement of lamps and electromagnetically operated signal plates.

1,198,674. Electrical Connector. H. S. Sines, assignor to Minerallac Electric Co., Chicago, Ill. Eyelet receiving conductor may be passed over binding post.

1,198,677. Panelboard With Switch. H. F. Starrett, assignor to Starrett Mfg. Co., Chicago, Ill. Special manner of mounting bases and switch on insulating plate.

1,189,680. Electric Starting and Generating Apparatus for Internal-Combustion Engines. A. H. Timmerman, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Motor and generator shafts have one-way clutch between them.

1,198,688. Collapsed-Tire Alarm. G. F. Young, Indianapolis, Ind. Normally closed switch opened by collapsing of tire.

1,198,695. Motor to Control Automatically a Subscriber's Telephone for Varied Service. E. V. M. Brennan, Philadelphia, Pa. Device raising receiver hook to connect in instrument, controlled by call bell, phonograph, timer, register, etc.

1,198,699 and 1,198,700. Control Device for Wireless Signaling. E. H. Colpitts, E. Orange, N. J., assignor to Western Electric Co., New York, N. Y. High-frequency systems employing thermionic amplifiers of the audion type.

1,198,703. Process for Obtaining Adhesive Coatings of Copper Upon Iron and Steel. S. O. Cowper-Coles. Westminster, London, England. Coated metal is immersed in nitric acid and then copper is electrolytically deposited first from an alkaline and then from an acid solution.

1,198,732. Plunger for Forming Insulators. L. P. Locke, assignor to Locke Insulator Mfg. Co., Victor, N. Y. Rotary and vertically movable die for line insulators.

1,198,734. Electric Lantern. E. Lundescher, Chicago, Ill. Details of battery device.

1,198,735. Motor. F. Lux, assignor of one-half to P. Lux, Waterbury, Conn. Electromagnetically controlled, weight-operated mechanism.

1,198,736. Electric Switch. J. F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Co. Details of two-way switch.

1,198,737. Electromagnetic Valve-Controller. J. F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Co. Electric reverser.

1,198,765. Telephone Attachment. W. W. Rainwater, Crews, Tex. Battery-circuit switch.

1,198,776. Apparatus for Producing Oscillating Current. J. Schiessler, Baden, Austria-Hungary. Comprises an incandescent, solid resistance in parallel with inductance and capacity, and having a fan to blow a cooling draft on said resistance, said fan having number of blades and speed proportioned to oscillations.

1,198,794. Electrical System. R. Varley, assignor to Varley Duplex Magnet Co., Jersey City, N. J. Magneto-generator ignition system.

1,198,802. Railroad-Crossing Signal. S. A. Williams, Los Angeles, Cal. Details of electrically controlled signboards.

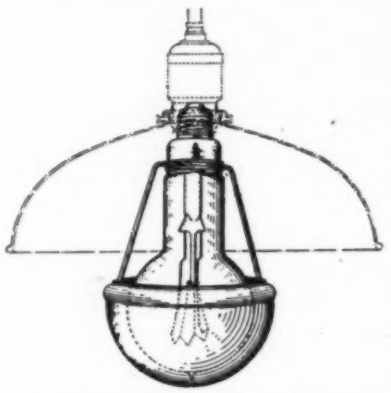
1,198,804. Circuit-Closer. H. L. Witt and S. Lookman, Pittsburgh, Pa. Normally open contacts closed by spring plunger normally retracted by weight.

1,198,828. Light Fixture. R. M. Dixon, assignor to Safety Car Heating & Lighting Co. For indirect lighting.

1,198,845. Temperature Alarm. S. I. Hendrix, Crescent City, Fla. Details of circuit-closer.

1,198,848. Lamp Lens. E. G. Johanson, Chicago, Ill. For headlight.

1,198,857 and 1,198,858. Electric Lighting. J. B. Lee, Savannah, Ga. Control of lamps



No. 1,198,483.—Shield Attachment for Incandescent Lamps.

in open-ended compartments supported by frame.

1,198,860. Circuit-Controller for Mechanically Playing Instruments. J. H. Lesley, and H. M. Enz, Pittsburgh, Pa. For sheet-controlled instruments.

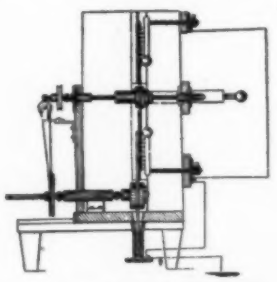
1,198,861. Circuit-Controller. J. H. Lesley, and O. T. Schoen, Pittsburgh, Pa. Modification of above.

1,198,867. Process for the Electric Treatment of Cellulose. A. L. Camille Nodon, Bordeaux, France. Cellulose is wetted with conducting fluid and alternating current passed.

1,198,873. Commutator Brush and Method of Making the Same. R. L. Seabury, Wellsville, N. Y. Arrangement of metal strands in carbon block.

1,198,889. Electrostatic Generator. W. H. Chapman, Portland, Me. Details of apparatus comprising a disk of insulation rotating in a tray of liquefied metal. (See cut.)

1,198,906. Electric Headlight. E. Fuchs, assignor to L. Renault, Billancourt, France.



No. 1,198,889.—Electrostatic Generator.

Support and arrangement of casing and reflector.

1,198,923. Electrically Operated Cutter. E. G. Johanson, Rockford, Ill. Structural details of electromagnetically operated device.

1,198,931. Holder for Lighting Glassware. E. J. Kulas, Cleveland, O., assignor to General Electric Co. For securing shades, etc.

1,198,934. Electric Engine. N. J. LeGrande, Goodwin, Ark. Armatures reciprocated by electromagnets operate crank shaft.

1,198,962. Electrical Protective Device. I. Rosenblum, assignor to General Electric Co., Schenectady, N. Y. A cutout comprising a film-like body largely of boron and carbon molecularly united therewith.

1,198,970. Electric Light Regulator. L. Sykes, and J. H. Nave, assignors to Any Lite Co., North Yakima, Wash. An adapter including a resistance.

1,198,987. Electrolytic Manufacture of Caustic Alkalis, Etc. E. A. Ashcroft, London, England. Cyclic process of producing anhydrous caustic alkalis.

1,198,988. Signaling Apparatus. E. Aiflero, assignor to Automobile Supply Mfg. Co., Brooklyn, N. Y. Diaphragm horn operated by electric motor.

1,198,995. Controlling Mechanism for Motor Cars. J. C. Brackett, Copper Cliff, Ontario, Canada. Has interdependent electromagnetic devices for controlling gear and clutch.

1,199,004. System of Motor Control. A. M. Grey, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Induction motor with flywheel automatically controls switch in supply circuit.

1,199,011. Printing Telegraph. C. L. Krum and H. L. Krum, assignor to Morkrum Co., Chicago, Ill. Arrangement of relays and switches in impulse-operated system.

1,199,023. Electric Signal Apparatus. G. Thompson, assignor to Autocall Co., Shelby, O. Structural details of motor-operated, rotary switch.

1,199,039. Electrical Compression Resistance Unit. P. J. Ray, Lakewood, O. Has conducting disks with surfaces coated with crystalline and amorphous carborundum with silicate of soda as adhesive.

PATENTS EXPIRED.

The following United States electrical patents expired September 26, 1916:

633,558. Electric Railway. R. W. Barkley, New York, N. Y.

633,565. Device for Lighting Lamps by Electricity. H. M. Brigham and S. M. Meyer, New York, N. Y.

633,567. Meter-Registering Device. J. M. Farron, Boston, Mass.

633,576 and 633,577. Casing for and Mounting for Electrical Fuses or Cutouts. L. W. Downes, Providence, R. I.

633,586. Printing-Telegraph System. C. L. Healy, Newark, N. J.

633,594. Electric Traction of Railway Trains. O. H. E. Kaselowsky, Berlin, Germany.

633,597. Sprinkler Car. J. B. Kenison, Lynn, Mass.

633,608. Advertising Street Annunciator for Cars. F. H. Patriarche, Toronto, Canada.

633,623. Street-Indicating Device for Street Cars. S. Squire, Westfield, and A. Knowles, New Bedford, Mass.

633,641. Dynamoelectric Machine. C. A. Eck, Newark, N. J.

633,675. Weighing and Package-Filling Machine. G. W. Watson, Boston, Mass.

633,690. Apparatus for Reproducing Motion. A. Franke, Berlin, Germany.

633,695. Motor-Meter for Three-Phase Currents. G. Hummel, Munich, Germany.

633,702. Electrical Measuring and Indicating Apparatus. C. F. Rodde, Gross Lichterfelde, Germany.

633,713. Electric-Motor Truck. W. E. Boughton, Philadelphia, Pa.

633,763. Motor Vehicle. L. Krieger, Paris, France.

633,771. Switch for Electric Circuits. H. Wright and C. Aalborg, Wilkinsburg, Pa.

633,772. Automatic Circuit-Breaker. G. Wright and C. Aalborg, Wilkinsburg, Pa.

633,773. Circuit-Breaker. G. Wright, Wilkinsburg, Pa.

633,786. Trolley Stand. H. W. Brooks, Braddock, Pa.

633,801. Means for Utilizing Galvanic Cells or Batteries. A. de Castro, New York, N. Y.

633,826. Electrically Operated Typewriter. W. R. Fox and G. J. Barrett, Grand Rapids, Mich.

633,829. Static Electric Machine. J. Gallegos, San Jose de Guatemala, Guatemala.

633,855. System of Electrical Distribution. B. G. Lamme, Pittsburgh, Pa.

633,856. Distributed Winding for Electrical Machines. B. G. Lamme and J. P. Mallett, Pittsburgh, Pa.

633,857. Dynamoelectric Generator. B. G. Lamme, Pittsburgh, Pa.

633,858. Field-Magnet Coil for Electrical Machines. B. G. Lamme, Pittsburgh, and C. E. Skinner, Wilkinsburg, Pa.

633,887. Electric-Railway Rail Bond. T. J. McTighe, New York, N. Y.

633,920. System of Electrical Distribution. L. B. Stillwell, Niagara Falls, N. Y.

633,951. Timing Device. W. M. Brown, Johnstown, Pa.

633,969. Automatic Electromagnetic Friction Brake. E. M. Tingley, Pittsburgh, Pa.

633,971. Car or Train-Lighting System for Electric Railways. E. R. Hill, Wilkinsburg, Pa.

633,972. Current Collector for Electrical Machines. B. G. Lamme, Pittsburgh, Pa.